

# METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

Founded as Metal Industry, January, 1903  
by Palmer H. Langdon, 1868-1935

SEPTEMBER, 1949

VOLUME 47 • NUMBER 9

## Editorial and Business Staff

L. H. LANGDON, *Publisher*  
PALMER H. LANGDON, *Assistant Publisher*  
THOMAS A. TRUMBOUR, *Business Manager*  
JOAN T. WIARDA, *Sales Manager*  
WALTER A. RAYMOND, *Engineering Editor*  
FERDINAND C. WEHRMAN, *Western Editor*  
FRED A. HERR, *Pacific Coast Editor*  
JOHN E. TRUMBOUR, *Equipment & News Editor*

Published Monthly by

**FINISHING PUBLICATIONS, INC.**

founded 1903 as

Metal Industry Publishing Co., Inc.

11 West 42nd St. New York 18, N. Y.

Telephone: PENnsylvania 6-0226

### Branch Offices

Chicago 11  
612 N. Michigan Ave.  
Whitehall 4-1920

Los Angeles 13  
424 S. Broadway  
MADison 6-5421

also publishers of

*Organic Finishing*, monthly, \$3.00 per year

Member



National Conference of Business Paper Editors

Copyright 1949 by Finishing Publications, Inc. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

**SUBSCRIPTION PRICES:** United States, \$4.00 and Canada \$4.00 per year. Other countries \$8.00. Single copies 45c in U. S. and Canada, Foreign 85c. Guidebook-Directory published as separate volume in pocket size form \$1.50. 1948 edition current. Please remit by check or money order; cash should be registered.

Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

## CONTENTS

Editorial .....	47
Where Do We Go From Here?—Part II—Electronics in Electroplating .....	48
<i>By Joseph B. Kushner</i>	
Immersion Plating of Zinc, Cadmium, and Tin on Aluminum Alloys .....	52
Sargent's New Finishing Department Exemplifies Close Co-ordination .....	57
<i>By Lawrence J. Durney</i>	
Electrolytic Polishing of Metallic Surfaces—Part IV ..	60
<i>By Dr. Pierre A. Jacquet</i>	
All Our Yesterdays—Part XI .....	68
<i>By Frederick A. Lowenheim</i>	
Shop Problems .....	75
Patents .....	77
Engineering Data Sheet .....	79
Recent Developments .....	80
Finishing Courses .....	89
Business Items .....	91
Electroplating in Japan .....	95
Letter to the Editor .....	99
New Book .....	100
Manufacturers' Literature .....	101
News From California .....	104
Associations and Societies .....	105

## COMING SOON

A special issue devoted to the theme "Economy in Production" containing articles describing modern ways to cut finishing costs.

Conditions for the safe use of electropolishing baths containing the versatile combination of perchloric and acetic acids.

Copper plating from various phosphoric acid baths.

A description of a "home made" automatic polishing and buffing machine for economical finishing of screw heads for bright plating.

A discussion of the use of hard nickel plating in the salvaging of worn machine parts.



## *"What's so good about H-VW-M cleaners?"*

THOMAS M. RODGERS

Field Representative, H-VW-M Philadelphia Office

**N**OW there's a man who wants facts," I thought, when a customer popped that question at me. It so happens that of all the H-VW-M items of electroplating and polishing equipment I handle, the "cleaners story" is one of my favorite subjects: "To begin with," I started, "we both know that the only way to get top-notch finishing by electroplating and anodizing methods is to have an absolutely clean metallic surface to work with. Poor adhesion, porosity, blisters, and other faults in final finishes can usually be traced to inadequate cleaning.

"That makes selecting the right cleaners for your work serious business," I continued. "Besides considering detergency value, you've got to think about such things as attack on metals, emulsifying power, electrical conductivity, chemical stability, and service life. And no one cleaner can do all jobs equally well.

"'A job for an expert,' you say? You're right! And that's where H-VW-M's long years of experience in solving cleaning problems comes in. Before recommending a cleaner we analyze pre-cleaning, cleaning and plating operations—consider materials to be removed after buffing and polishing—the condition of the surface . . . whether there is packing in the recesses . . . effect of stacking. We also check base metal being used—whether D.C. or R.C. is required—whether cleaning operations passivate or activate.

"That makes it easy, doesn't it," I concluded. "All you have to do is tell us what your cleaning problem is and we'll recommend the right cleaner you need to prepare your metallic surfaces for finishes you'll be proud of . . . and at savings you'll appreciate."

Ask your H-VW-M representative for full information on our complete line of cleaners, or write to 'Headquarters'\* for Bulletin C-105.



\*Hanson-Van Winkle-Munning has supplied the plating industry for over 70 years. Our sales-engineers are thoroughly familiar with every step in the process of electroplating and polishing. It is this overall knowledge that has made H-VW-M "Headquarters" for electroplating and polishing equipment, supplies and technical assistance.

### **HANSON-VAN WINKLE-MUNNING COMPANY MATAWAN, NEW JERSEY**

Manufacturers of a complete line of electroplating and polishing equipment and supplies

Plants: Matawan, New Jersey • Anderson, Indiana

Sales Offices: Anderson • Chicago • Cleveland • Dayton • Detroit

Grand Rapids • Matawan • Milwaukee • New Haven • New York • Philadelphia

Pittsburgh • Rochester • Springfield (Mass.) • Stratford (Conn.) • Utica



5861

# METAL FINISHING

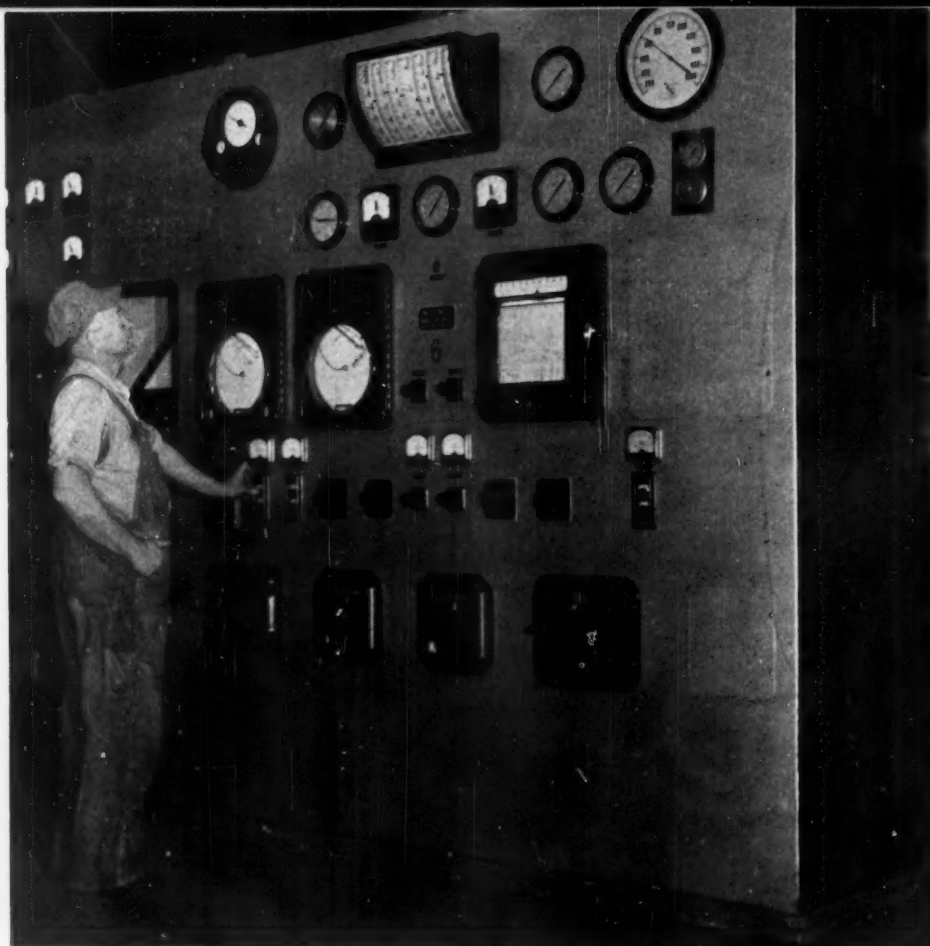
## Pre-View Of Coming Attractions

Electrochemists and electroplaters in the Chicago area are doubly fortunate this year, for in addition to having had the recent annual convention of the American Electroplaters' Society in their "back yard" (Milwaukeeans will insist that it was their front yard), their city will also be the scene of the 96th meeting of the Electrochemical Society on October 12-15, at the LaSalle Hotel. A special symposium on electro-deposition to be held on Saturday, October 15, will be of special interest, and is open to all persons interested in electroplating and related operations.

The Electrochemical Society could justifiably be called the Research Department of the plating industry, and it is regrettable that meetings of the Society have not in the past been as well attended by practical platers as they deserved to be, for the technical achievements first reported before this Society have been the basis for the later development of nearly all the commercial plating processes of today. The practical plater will find these sessions far from "stuffy" and "high-brow", and may be surprised to find that the various researchers reporting on their work at these sessions are just as concerned about such practical matters as adhesion and brightness of the deposits, bath life, controls, etc., as his more "practical" brothers are.

Research in electroplating usually starts with the development of a suitable plating bath, and what may seem to be only of academic interest to the plating industry today could be an important commercial process tomorrow. The really "practical" plater who wants to know as much as possible about not only the present status, but also the paths of future development of his industry, would do well to attend this meeting and enter into the discussions. Such a "Pre-view of Coming Attractions" cannot help but be interesting and broadening.

*W. A. Raymond*



Will tomorrow's plating  
be done this way?

(Photo courtesy Leeds & Northrup Co.)

## Where Do We Go From Here? Part II—Electronics in Electroplating

By Joseph B. Kushner, *Metal Finishing Consultant, Stroudsburg, Pa.*

**P**ICTURE to yourself a modern plating plant in which a plater has little else to do but load and unload work at a given tank. He does not have to adjust the current every time he hangs a rack on the cathode bar nor does he have to adjust the current every time he removes a rack from the tank. The current density on the work, regardless of how full or empty the cathode bar is, is always kept constant at the optimum value; the metal content of the bath is always the same, so little or no analysis is required; the pH is automatically controlled; brightening and addition agents are automatically fed to the solution and constantly maintained at the correct concentration; the solution is continuously filtered, automatically, without attention on the part of the plater; bath temperature is always uniform and constant and water evaporation losses are continually replenished; impurities of a harmful type which work themselves into the solution in the course of ordinary plating operation are continuously purged from the solution so that the concentration of such impurities is always below the danger point; large amounts of impurities which may get into the bath by accident make themselves manifest im-

mediately to the operator by ringing a warning alarm so that no work is ruined by being placed into the tank with this high concentration of the contaminant present. As soon as the impurity has its concentration reduced below the harmful level by the automatic purification system, a signal indicates this fact and plating goes on as usual. Uneventful, uniform operation, day in and day out, with aspirin tablets back on the druggist's counter where they belong!

Does this sound like a plating millenium—an impossible plater's pipe dream? As a matter of fact, it's not. It's on the way and will be here sooner than we think, because of modern electronics.

Electroplating has resisted the inroads of electronic control ever since it was discovered that vacuum tubes could be used for purposes other than radio, but now, slowly and surely, electronic controls are making their appearance in the plating field—and it's about time! Electronic gadgets are doing everything but diapering the baby in other industries, so why not in the plating industry? The applications are there, the circuits and controls are available, so why not combine them?

We already have a few applications in the way of



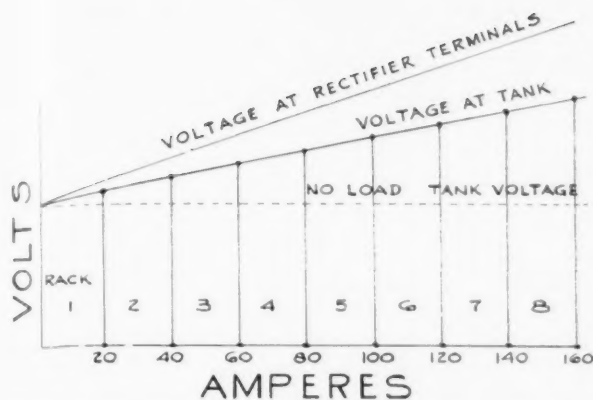


Figure 1—Correct rectifier characteristics for constant current density plating.

temperature and level control and to a limited extent pH control, and there are some applications in connection with strip and wire plating, but that's about all. Let us take a look at our "dream" plating operation and see where electronic and automatic assistance would be of real help.

#### Automatic Plating Current Control

One of the common nuisances in a plating operation where there is a continually varying load is the continual adjustment of the current that has to be manually performed by the plater. When a rack of work is placed into the tank, the current control has to be adjusted so that the proper current density is obtained on the work. If a second rack goes in, a new adjustment must now be made so that the proper current density obtains on both racks, and so on down the line until the tank is full. The same re-adjustment chore must be performed when the tank is partially unloaded. Should the plater forget to make a required adjustment or should he make it improperly, the work is burned or underplated or insufficiently bright. Electronic control can be of real help here.

When the first rack goes into the tank, the work suspended thereon presents a certain definite area, and by adjustment of the voltage across the tank a definite current density (average) can be obtained on the work. When a second rack of work is hung on the cathode bar the effective conducting area is increased, and if the voltage across the tank is kept constant, the current flowing will increase *approximately* in proportion to the new amount of area exposed in the tank. In actual practice however, the voltage across the tank must be raised somewhat to maintain the same current density as before on the *two* racks, because the increasing load causes a voltage drop at the tank. If a third rack is placed in the tank, the voltage must now be increased again for the current density to be the same on all the racks.

If you plot a curve giving the voltage and current relationship at the tank with respect to the number of racks in the tank, starting with open tank voltage, so that the same current density is kept on all the racks, you will get a straight line something like Figure I. This "curve" gives the correct voltage that must be placed across the tank for each increase in load in

order that the current density be kept constant on all the racks.

It is possible to design an electronic circuit which will so control a direct current source that its output will lie along the same line. This may sound like a lot of double talk, but simply speaking it means an electronic arrangement can be devised to automatically raise or lower the voltage at the tank by the proper amount to establish the correct density on the rack or racks being plated, without need of manual adjustment. Please note that electronic devices already have been devised to maintain a *constant voltage* across the plating tank or a *constant current*. This new arrangement will *vary* the voltage across the tank according to the area of work exposed in the tank so that a *constant current density* is produced on the work regardless of the number of racks in the tank.

There are several possible ways for doing this and electronic engineers in this country and abroad are engaged with the problem at the present time. One such method recently proposed by English engineers<sup>1</sup> is schematically illustrated in Figure II. The method cannot be considered an electronic method to the purist, since it does not make use of vacuum tubes, but nevertheless, it is in the broadest sense an electronic control.

According to the diagram, the A.C. current passes from a motor driven variable transformer, through a small current transformer and into the main transformer and rectifier stack where it is converted into low voltage D.C. This low voltage D.C. is then fed to the plating tank. Connected across the tank is another circuit as shown, which consists of 2 potentiometers  $P_1$  and  $P_2$  and a special relay  $R$ , which operates the variable transformer motor  $M$ . The voltage drop across  $P_1$  is produced by a dry cell and the voltage drop across  $P_2$  is produced by the rectifier output of the small current transformer  $C$ .

Its manner of operation is fairly simple. With potentiometer  $P_2$  completely out of the circuit, it acts as a constant voltage device in this way: Let us say we want a constant voltage of 6 volts delivered to the

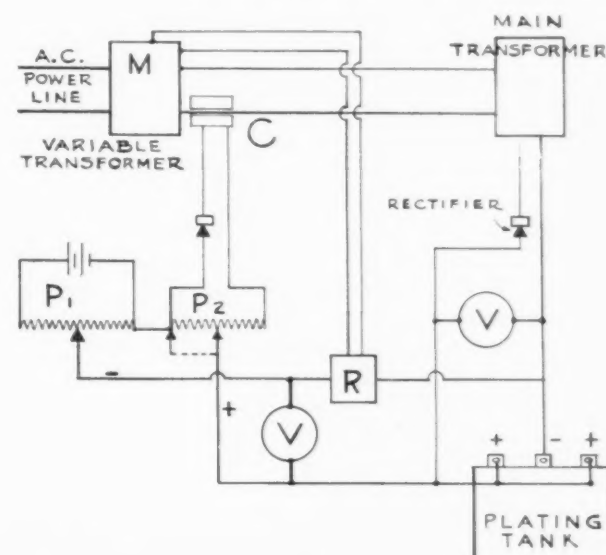


Figure 2—Relay type constant current density plating system.

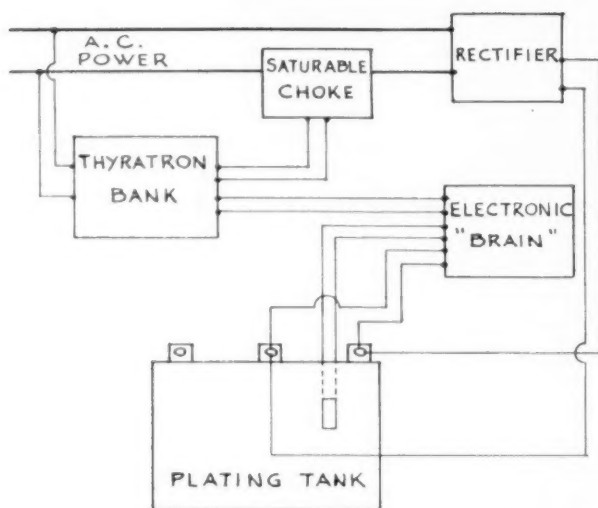


Figure 3—Electronic constant current density plating system.

bath. We adjust  $P_1$  until the voltmeter reads 6 volts. Now if the voltage at the bath is 6 volts, no current will flow through the relay because the 2 voltages are of opposite polarity and equal (they buck each other). Suppose a large load of work is put into the tank. The voltage will drop at the tank due to the load, so that now some current will flow through the relay in such a direction as to actuate it to cause the motor driving the variable transformer to increase the input at the rectifier, which will in turn increase the D.C. voltage at the tank until it is equal to 6 volts; the circuits will be balanced again and the relay will cease to operate. On the other hand, if some work is removed from the tank now, the voltage at the tank may rise a little bit above 6 volts, which will cause the relay to be actuated in the opposite direction, reversing the driving motor and lowering the A.C. input to the rectifier and thus lowering the D.C. voltage at the tank to 6 volts. In this way we have a constant voltage device.

To operate the gadget as a constant current density control, we first adjust the no load voltage with  $P_2$  cut out and the tank empty. Now a load is placed in the tank. The tank voltage will remain constant, but as we have seen, in order to get the correct current density on a second rack the voltage at the tank must be raised higher. This is accomplished after placing a second rack in the tank by putting  $P_2$  into the circuit and adjusting it until the relay is caused to operate the variable transformer motor in such a way as to raise the voltage to the desired point according to the previously constructed graph. Once done, no other adjustment is required. Since the amount of current flowing to the main transformer is proportional to the amount of current flowing at the load, an increase in the load at the tank will raise the "bucking" potential and actuate the relay to raise the voltage at the tank until the voltage at the tank is equal to the "bucking" voltage, which because of the initial adjustment of  $P_2$ , will fall on the desired straight line.

As an example, suppose the plating bath is cyanide copper, and the current density desired is 20 amperes per rack of work. Every time a rack is placed into the tank, the current must increase by 20 amperes in order to keep a constant current density. When a second

rack is placed in the tank the amperage increases and the voltage at the tank drops and the relay will be actuated to restore at the tank the initial voltage plus a sufficient increment in voltage to give 40 amperes, according to the prearranged setting of  $P_2$ .

This is a rather long winded description of an action that takes place in a few seconds, which is sufficiently fast for most plating purposes. More desirable however, would be a true electronic system which would respond instantaneously. Furthermore, the system just described fails if the solution goes out of balance (its conductivity increases or decreases) or the pieces on the racks are drastically different in shape. If, for example, the bath were a cyanide copper bath and some cyanide were added to it, the conductivity would be increased and the application of the same reference voltage as before would now give higher current densities than normal which would require a new adjustment for the system. Similarly if some pieces were much closer to the anodes than others because of their shape, failure would result.

Accordingly, an electronic device that would automatically compensate for these possible variations is what is needed. Not being an electronic engineer, this author nevertheless feels certain there must be several different ways in which this could be accomplished. As shown schematically in Figure III, thyratrons, controlled by information given them by an electronic "brain" which combines the pertinent facts of solution resistance, tank voltage and shape factor, in turn control the input to a plating rectifier and thus its output. In this way smooth instantaneous response that automatically compensates for variations in solution resistance and shape changes could be achieved.

#### Automatic Metal Content Control

One of the problems in plating is keeping the metal content of the plating bath at a constant value. With

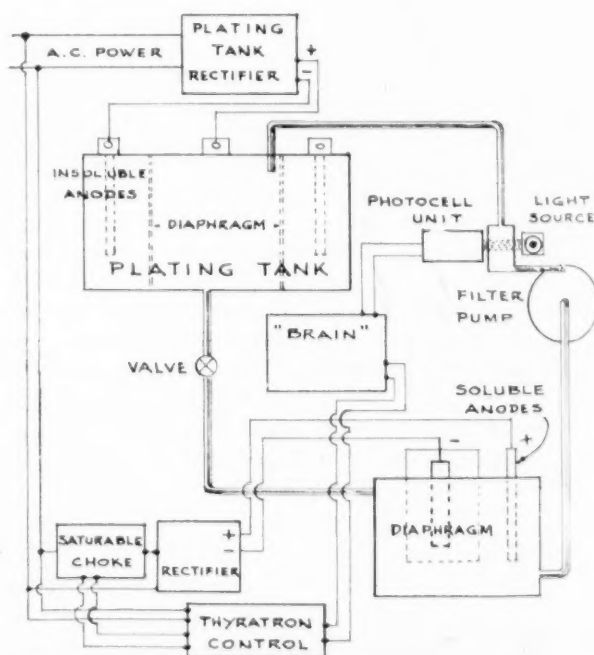


Figure 4—A theoretical system for maintaining a constant metal content in a plating bath.

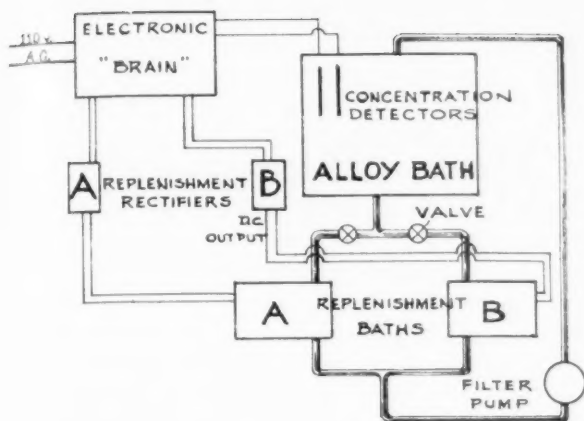


Figure 5—A theoretical system for maintaining constant metal ratio in an alloy plating system.

the bath loaded and in operation, the ideal set of conditions would be such that the amount of metal dissolved at the anodes would just make up for that plated out and lost by drag-out. In practice this can be approximated only very rarely. Actually what happens in many cases is that the anode efficiency is much higher than required so that the metal content of the bath goes up, or it is much lower, or nil, so that the metal content goes down. The acid copper sulfate bath is an example of the first class and the chromium bath an example of the second class.

Let us take as an example the copper sulfate bath. Here the anode efficiency is in excess of what is required so that the copper content of the bath goes up and the acidity goes down. How can a system be devised to always keep the copper content at the same point? Electronically speaking, there are probably at least two or three ways for doing this. One way that suggests itself is shown schematically in Figure IV. A vacuum tube actuated by a photocell controls a thyatron which in turn controls the current that feeds the replenishment tank. If there is too much copper in solution, an insufficient amount of light reaches the photocell which, acting through the thyatron, lowers the current to the replenishment tank. If the copper sulfate content goes down, the photocell gets more light than required and it actuates the thyatron to

increase the current to the replenishment tank. This arrangement could very well tie in with the diaphragm method of plating proposed recently at the 1948 A.E.S. Convention<sup>2</sup>.

This problem of replenishment to maintain constant metal content is particularly crucial in alloy plating—the more alloy components present, the more crucial it becomes—and here is where electronic control could really shine. Take as a hypothetical example a two component alloy system as shown in Figure V. In the plating bath proper work is plated using insoluble anodes behind diaphragms. The plating electrolyte is split into two streams one of which goes to a replenishment tank for component A and the other to a replenishment tank for component B. At the plating tank some physical, electrical or chemical property of component A can be used to actuate a thyatron to control the current to replenishing tank A and a similar set up for component B can be used to control the

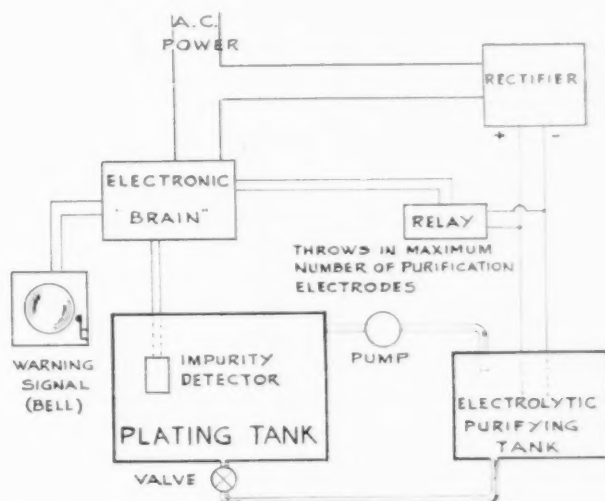


Figure 7—An electronic system for detecting the presence of undesired contaminants in a plating system.

current to tank B. In this way constant metal content of both alloy components can be maintained in the plating bath. This is something the plating industry is awaiting with open arms!

### Automatic Replenishment of Brighteners

The problem of when and how much brightener to add to a plating tank for optimum results is another nuisance problem that can readily be solved by electronics. It is true that systems have been devised based on the use of an ampere hour meter such as illustrated in Figure VI, which will intermittently add brightener automatically after a certain number of ampere hours have elapsed, but for better results what would be desired is a control that would continuously keep the brightener at the optimum value. Based on a polarization property which would in turn effect the grid potential of a suitable vacuum tube, or a photocell light reflectance principle, a system could be devised to feed brightener to the plating tank so as to maintain the optimum concentration.

(Concluded on page 74)

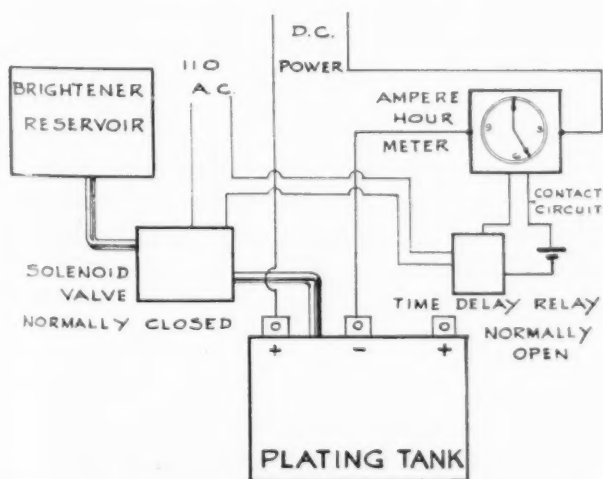


Figure 6—Automatic control of brightener by a relay actuated system.



# Immersion Plating of Zinc, Cadmium, and Tin on Aluminum Alloys

Abstracted from an article by Samuel Heiman, which appears in the May 1949 issue of the *Journal of The Electrochemical Society*. The complete paper will be presented at the Chicago Meeting of the Society, Oct. 12-15.

**E**LECTROPLATED finishes on aluminum are assuming a place of ever increasing importance, due to the favorable combination of light weight and decorative and protective value of such coatings. The technical difficulties in obtaining smooth adherent coatings by the usual electrodeposition methods stem from the high potential of the metal, which tends to produce loosely adherent films upon immersion in ordinary metallic baths, as well as the ever-present oxide film which also prevents adequate adhesion.

Five general methods have been used to overcome these difficulties, as follows:

- 1) Etching the surface in a mixture of nitric-hydrofluoric acids, followed by nickel plating. Adhesion in this case depends mostly on the "keying" action of the etched surface.
- 2) Depositing a bonding metal by immersion, this bonding metal then serving as a base for subsequent deposits of other metals. The zincate immersion process widely used at present is a good example.
- 3) Anodizing, followed by plating a metal which fills the pores of the oxide coating. Again the adhesion depends on the keying action primarily.
- 4) Use of special plating baths. Zinc and chromium have been reported as being of limited use, but other metals do not have the degree of adhesion required.
- 5) Miscellaneous methods, such as immersion from salt baths, etc. The high temperatures required in this process affect the physical properties of the base metal greatly.

Of the above procedures, only the zincate immersion process and the anodic oxidation process have met with any commercial success. The former is applicable to more alloys, requires less equipment and time, and the conditions are less critical. (An extensive bibliography of the above methods is given in the original article.)

The initial purpose of this research was to electro-

plate, or deposit by immersion, metals other than zinc and obtain a deposit equal to or better in quality than that obtained by the zinc immersion process. A study of copper was undertaken first and an intensive study of cyanide copper solutions was made. This type of solution has the advantage of being alkaline for the removal of the aluminum oxide and having a cyanide complex to decrease the copper ion concentration and favor immersion deposits of good structure. Fair adhesion was obtained on 24ST alloy but only poor adhesion on 2S aluminum.

Considerable exploratory work was carried out in an effort to obtain immersion cadmium coatings which would be a satisfactory base for plating. Cyanide cadmium solutions were tested over a wide range of conditions. The cadmium immersion deposits had excellent appearance and structure, but copper subsequently electroplated on these coatings blistered. The separation occurred between the cadmium and aluminum.

Since efforts to deposit copper and cadmium from alkaline solutions were unsuccessful, attention was directed toward the acid type solutions. Such a solution must contain a compound which has a solvent action on the aluminum oxide. The formation of a complex compound containing the metal is desirable in order to decrease the rate of deposition by immersion and to favor sound immersion deposits. Hydrofluoric acid and the fluoride salts have these properties to a striking degree; accordingly, they were investigated.

## *Preliminary Experimental Work with Solutions Containing Hydrofluoric Acid*

Exploratory tests were carried out in which, in general, hydrofluoric acid was added to solutions of various metal salts, and the quality and adhesion of the immersion deposits produced on the aluminum were noted and studied. The metals studied were zinc, cadmium, tin, and copper.

During the course of this exploratory work, modifications and improvements were constantly made and these will be discussed before presenting the standard procedure which finally was evolved.

The aluminum panels were 2 inch x 0.875 inch x



0.051 inch (5.08 cm. x 2.22 cm. x 0.130 cm.) and had a total area of 0.025 sq. ft. (0.23 sq. dm.). The chemicals were reagent grade and in most of this research, commercially pure aluminum (2S) was used.

**Cleaning the aluminum.**—A standard method for preparing aluminum for plating by the zinc immersion process using sodium hydroxide followed by nitric acid proved to be satisfactory in the initial work, although it etches the surface of the aluminum. The procedure was as follows: (a) cleaner = sodium hydroxide, 50 g./l., 30 seconds at 80°C.; (b) nitric acid (sp.gr. = 1.42), 70 per cent by volume, 15 seconds, for film removal.

The chrome pickle procedure described by Bengston also was satisfactory.

A dilute hydrofluoric acid dip for the purpose of removing gross oxide and activating the surface of the aluminum prior to the immersion dip yielded the best results. It was found that any treatment prior to the hydrofluoric acid was not significant and could be reduced to a degreasing operation using either a solvent, such as trichlorethylene, or an inhibited alkaline cleaner. Thus, the aluminum could be pre-cleaned in sodium hydroxide or in the chrome pickle, but these treatments are not essential. The concentration of the hydrofluoric acid was not critical and time of treatment may vary from one to three minutes at a temperature of 25°C. The surface of the 2S aluminum was not roughened seriously by this dip.

**Film removal.**—The film remaining on the aluminum after the reaction with the dilute hydrofluoric acid consists of the metals which were alloyed with the aluminum. It may be removed readily by dissolving in 70 per cent by volume nitric acid at room temperature. The time is not critical and may vary from ten to twenty seconds. This process is followed by a cold water rinse. Warm or hot water should not be used in any rinse process because of the tendency to form a relatively heavy oxide film on the aluminum which may interfere with the subsequent immersion process.

**Immersion process.**—In the early exploratory work, metal chlorides were evaluated in combination with hydrofluoric acid. It was soon found that, in general, better deposits were obtained when the heavy metal sulfate was used instead of the chloride. Considerable work was carried out to determine the specific effects of variation in the concentrations of the metal sulfate and hydrofluoric acid on the quality of the metal immersion deposits.

Addition agents were found to be valuable in improving the structure and adhesion of the immersion deposits and consequently were studied in some detail. Glue was used in the cadmium and early zinc work, whereas glue, goulac, and purified residue acid were used in the tin solutions.

Mild agitation of the panel in the immersion solu-

tion was found to have a beneficial effect and, therefore, was made standard practice in all of the work.

The quality and structure of the immersion deposits were determined by visual inspection and by rubbing the deposit where the aluminum panel had been bent through 180 degrees. More complete evaluation of the adhesion of the zinc film to the aluminum was obtained by qualitative and quantitative adhesion tests on the heavy copper deposit subsequently plated on the zinc.

**Plating on the immersion deposit.**—In the exploratory work, copper was plated directly on the zinc film from a copper pyrophosphate plating solution. However, poor adhesion between the zinc and the copper frequently occurred, and it appeared that the zinc deposited from the acid solution was more active than that deposited from the zincate solution and that this contributed to the poor adhesion. This difficulty was eliminated entirely by the use of a special cyanide copper strike on the zinc prior to the plating from the copper pyrophosphate bath.

The best results were obtained with zinc immersion coatings and the poorest with copper; the cadmium and tin coatings were intermediate in the degree of adhesion on aluminum. Consequently, the most intensive work was carried out with zinc deposits.

### Standard Procedure

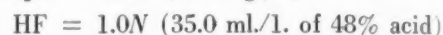
On the basis of the preliminary research described above, the following standard procedure was selected and used in the experimental work with zinc, cadmium, tin, and copper immersion baths containing hydrofluoric acid or fluoride salts.

- (a) Cleaner  
Bath:  
Inhibited alkaline cleaner . . . . . 45 g./l.  
Time . . . . . 3-5 minutes  
Temperature . . . . . 80°-90°C.
- (b) Cold water rinse
- (c) Acid dip  
Bath:  
Hydrofluoric acid . . . . . 0.5N  
Time . . . . . 2-3 minutes  
Temperature . . . . . 25°C.
- (d) Cold water rinse
- (e) Film removal  
Bath:  
Nitric acid (sp. gr. 1.42) . . . . . 70% by volume  
Time . . . . . 10-20 seconds  
Temperature . . . . . 25°C.
- (f) Cold water rinse
- (g) Immersion dip  
Bath:  
For compositions studied, see next section on "Immersion Baths."  
Time . . . . . 5-60 seconds  
Temperature . . . . . 25°C.  
Mild agitation
- (h) Cold water rinse

- (i) Copper strike  
Bath:
- |                       |  |
|-----------------------|--|
| Copper cyanide        | 20.0 g./l.   |
| Sodium cyanide        | 23.0 g./l.   |
| Sodium carbonate      | 30.0 g./l.   |
| "Free" sodium cyanide | 0.3 g./l.  |
| Temperature           | 25°C.  |
| pH                    | 10   |
| Current density       | 20-30 amp./sq.ft.<br>(2.2-3.2 amp./sq.<br>dm.) for 10 sec-<br>onds, then 5 amp.<br>/sq.ft. (0.54 amp.<br>/sq.dm) for about<br>one minute |
- (j) Cold water rinse
- (k) Copper plate  
Bath:
- Copper Pyrophosphate solution
- |                  |                                     |
|------------------|-------------------------------------|
| Current density  | 30 amp./sq.ft.<br>(3.2 amp./sq.dm.) |
| Time             | 18 minutes                          |
| Thickness copper | 0.0005 inch (0.013 mm.)             |
- (l) Cold water rinse
- (m) Nickle plate (Plated only for adhesion tests, described later)  
Bath:
- |                       |                                     |
|-----------------------|-------------------------------------|
| Nickel sulfate        | 240 g./l.                           |
| Nickel chloride       | 45 g./l.                            |
| Boric acid            | 30 g./l.                            |
| Sodium lauryl sulfate | 2 g./l.                             |
| Temperature           | 55°C.                               |
| pH                    | 5.2                                 |
| Current density       | 30 amp./sq.ft.<br>(3.2 amp./sq.dm.) |
| Time                  | 20 minutes                          |
| Thickness nickel      | 0.0005 inch (0.013 mm.)             |
- (n) Preliminary qualitative adhesion tests
- Panel bent in half through 180 degrees. Peeling or flaking of deposit observed especially at the bend.
  - Heating tests.
    - Oven test: 150°C. for 15 minutes
    - Furnace test: 300°C. for 2 hours
    - Examine under a microscope (15×) for blisters.

### Zinc Immersion Baths

There is a considerable area of concentrations of the two components at which excellent deposits may be obtained. For general plating purposes, a bath composition well within the desirable area may be taken, for example:



The zinc immersion deposits obtained in the preferred area had a clean, uniform, gray color. Spotty or streaked deposits were obtained from solutions containing excess hydrofluoric acid and were an indication of inferior adhesion of the plated coating.

### ZINC SULFATE-FLUORIDE SALT SYSTEM

It was shown in the work of *Clay* and *Thomas* that while certain acids, particularly hydrofluoric acid, are effective solvents for hydrous alumina, it is the anion of these acids which is the effective agent.

Accordingly, various fluoride salts in combination with zinc sulfate were evaluated as immersion dip solutions. The aluminum panels were treated by the standard procedure and the plated coatings evaluated for adhesion by the bend and furnace tests. The results of these tests are given in Table I.

From the above data it is seen that the fluoride salts are just as effective as hydrofluoric acid. Furthermore, the salt is easier to handle than the acid both for preparing the solution and making additions.

### STUDY OF THE HYDROFLUORIC ACID DIP

The effect of varying the temperature and concentration of the hydrofluoric acid dip was studied for its effect on the quality of the zinc immersion coating as measured by the furnace test on the copper electrodeposits. The standard experimental procedure was otherwise the same as previously described.

Tests were made with 0.5N hydrofluoric acid at 40°C. and the results compared with those obtained at the standard 25°C. It was found that, in general, the activity of the reaction of hydrofluoric acid on aluminum at 40°C. was approximately twice that at

TABLE I

Fluoride salt	Concentration of fluoride salt mixed with 5N $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ at which	
	Copper deposits on zinc film passed furnace test	Precipitate formed $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ -fluoride salt mixture
Sodium fluoride, NaF	0.2N-0.4N	0.4N
Potassium fluoride, $\text{KF} \cdot 2\text{H}_2\text{O}$	0.2N-0.4N	0.4N
Ammonium fluoride, $\text{NH}_4\text{F}$	0.2N-1.0N	1.0N
Ammonium acid fluoride, $\text{NH}_4\text{F} \cdot \text{HF}$	0.2N-1.0N	1.0N

25°C., and the minimum time in the acid dip, therefore, could be halved.

In general, the 0.5N solution at room temperature is recommended and the time of dip should be sufficient to activate the surface and permit maximum adhesion without removing too much metal and possibly etching the aluminum.

The immersion time was not critical, and satisfactory deposits were obtained when the time varied from 10 seconds to 2 minutes. The zinc films had a uniform gray color. On the basis of this work, the preferred time in the zinc immersion solution was 30 to 60 seconds.

#### IMMERSION DEPOSITS UPON VARIOUS ALUMINUM ALLOYS

The following aluminum alloys were plated using the standard procedure given above: 24ST, 52S, 61ST. These alloys were chosen as representative of the various types of wrought aluminum alloys.

Excellent zinc immersion deposits were obtained with all the alloys. Several specimens of each alloy were plated with both 0.0005 inch of copper and 0.0005 inch of nickel and these panels were tested by the bend test, furnace test, hack saw test, and grinding wheel test. All panels passed these tests.

#### ADHESION TESTS

Qualitative adhesion tests were made on the 2S aluminum, and several aluminum alloys, which were pretreated and plated according to the standard procedure. The zinc immersion solution had the following composition: zinc sulfate = 5N; hydrofluoric acid = 1N. The alloys tested were 2S, 24ST, 52S, and 61ST; these alloys were chosen as being representative of the various types of wrought aluminum. The various panels were plated with either 0.0005 inch copper or 0.0005 inch copper plus 0.0005 inch nickel. After each adhesion test, the panels were examined under a 15× microscope for evidence of blistering or separation of the plated coating from the basis metal.

The various copper plated panels were subjected to the following tests:

(a) *Bend test.* The panel was bent through 180 degrees and then hammered flat.

(b) *Furnace test.* The panel was heated in a furnace at 300°C. for two hours.

(c) *Solder test.* A 0.040 inch diameter copper wire was soldered to the panel and then pulled to the breaking point. In all these tests the fracture took place in the solder and the plate did not lift off the base metal.

(d) *Burnishing test.* The panel was burnished with the peen of a hammer having a one pound head.

The various copper and nickel plated panels were subjected to the following tests:

(e) *Hammering test.* The panel was struck vigorous blows with a hammer.

(f) *Sawing test.* The panel was cut with a hack saw.

(g) *Grinding wheel test.* The end of the panel was

held perpendicularly against a 10 inch diameter, 70 grit emery wheel revolving at 1800 r.p.m.

In all of these tests with the 2S and various aluminum alloys, there were no signs of blistering or separation of the plated coating from the base metal.

#### Cadmium Immersion Baths

Certain information, learned from the zinc deposition work, was found to be applicable to the research on the cadmium. For example, the precleaning in hydrofluoric acid and the cyanide copper strike were found desirable and useful.

On the other hand, exploratory work with the cadmium sulfate-hydrofluoric acid system showed that certain experimental precautions were necessary. They were:

(a) An addition agent was required.

(b) Good agitation of the aluminum panel in the cadmium solution was necessary to obtain deposits of uniform, sound structure.

(c) The time of dip was important and more critical than with zinc.

(d) For testing the adhesion of the copper deposits on the cadmium immersion coating in this exploratory work, main reliance was placed on the bend test. Although the oven and furnace tests were also used, there is some doubt as to their validity because the brittle alloy of cadmium and copper which is formed when cadmium plated brass or copper is heated to 100°C. will itself cause blistering.

In the experimental work to be described, the standard pre-cleaning and copper plating procedure was used. The cadmium immersion dip procedure was as follows:

Aluminum	= 2S
Immersion dip:	
Cadmium sulfate	= Concentration varied
Hydrofluoric acid	= Concentration varied
Hydrolyzed glue	= 2 g./l.
Time	= 5-15 seconds
Temperature	= 25°C.
Agitation of panel	= Fairly vigorous

The results were much better with this system than with the cyanide cadmium solution. These cadmium immersion deposits had excellent color and structure and could not be rubbed off. Furthermore, these deposits could act as bases for heavy copper electrodeposits which did not flake or blister when subjected to the bend and oven tests. Extensive qualitative and quantitative adhesion tests similar to those made with the zinc deposits were not made in this study.

A preferred composition is as follows:

CdSO <sub>4</sub>	= 0.035N (3.6 g./l.)
HF	= 3.0N (105.0 ml./l. of 48% acid)
Hydrolyzed glue	= 2.0 g./l.

#### Tin Immersion Baths

Tin may be deposited by immersion on aluminum from stannate solutions and this process is used commercially for tin coating aluminum pistons. Laboratory evaluation of this process indicated that while



sound tin deposits may be obtained, the conditions are relatively critical and copper electroplated on these tin coatings blistered, indicating relatively poor adhesion of the tin on the aluminum.

The exploratory work with the tin system was simplified by the general experience gained in the work with zinc and especially with cadmium to which it was even more similar. Stannous sulfate-hydrofluoric acid mixtures were studied with and without addition agents. The results were as follows:

(a) Without addition agents, a heavy, black, pulverulent deposit of tin was precipitated on the aluminum and could be easily wiped off. The addition of glue and cresylic acid, the classical addition agents in the tin sulfate electroplating bath, to the stannous sulfate-hydrofluoric acid system resulted in sound, homogeneous tin deposits. Further improvement was effected by using a mixture of hydrolyzed glue, goulac, and purified residue acid.

(b) Good agitation of the aluminum in the tin solution is essential for sound tin immersion deposits.

(c) The optimum time of immersion of the aluminum in the tin solution is important for good results and is relatively critical.

Following the exploratory work, a series of tests were made to determine the range of  $\text{SnSO}_4$  and HF concentrations at which the best tin immersion deposits may be obtained. The standard procedure was exactly as outlined for zinc above. The special data for the tin immersion solution were as follows:

Aluminum	= 2S
Immersion dip:	
Stannous sulfate	= Concentration varied from 0.5 to 2.5N
Hydrofluoric acid	= Concentration varied from 0.25 to 5.0N
Hydrolyzed glue	= 1.0 g./l.
Goulac	= 0.2 g./l.
Purified residue acid	= 1.3 ml./l.
Time	= 5-10 seconds
Temperature	= 25°C.
Agitation of panel	= Fairly vigorous

The following conclusions appear justified:

(a) Excellent tin immersion deposits on aluminum may be obtained from this system over a wide range of concentrations of stannous sulfate and hydrofluoric acid.

(b) A preferred composition for depositing tin on aluminum by immersion would be:

$\text{SnSO}_4$	= 1.5N (161.1 g./l.)
HF	= 2.0N (70.0 ml./l. of 48% acid)
Hydrolyzed glue	= 1.0 g./l.
Goulac	= 0.2 g./l.
Purified residue acid	= 1.3 ml./l.

(c) The tin deposits are not as good as the zinc immersion deposits as a basis for further plating, but they are much better for this purpose than the tin immersion from the stannate bath.

### Copper Immersion Baths

The various efforts to plate or deposit copper by immersion upon aluminum described earlier were unsuccessful. The successful application of fluorides in the zinc, cadmium, and tin work, however, led to a consideration of the use of fluorides in copper deposition.

Some exploratory work was carried out with the copper sulfate-hydrofluoric acid system in an effort to deposit copper by immersion on aluminum. The standard pre-cleaning and plating procedure given earlier and the general experience gained from the earlier fluoride work were utilized in these tests. The general data on the copper immersion dip solution and the range of the conditions which were tested were as follows:

Aluminum	= 2S
Immersion dip:	
Copper sulfate	= 0.1 to 3.0N
Hydrofluoric acid	= 0.1 to 1.0N
Hydrolyzed glue	= 0 to 2 g./l.
Time	= 5-60 seconds
Temperature	= 25°C.
Agitation of panel	= None to fairly vigorous agitation

In all the conditions tested, the adhesion of the copper deposited on the aluminum was nil and no preferred composition can be given. Depending upon the structure of the copper, the deposits could be either wiped or peeled off the aluminum. Over the range of the experimental conditions tested, no trends or indications pointing to improved adhesion were found. The addition of glue generally improved the structure of the immersion copper deposits.

The poor results with copper deposits on aluminum compared with the excellent zinc deposits may be caused by the following factors:

(a) The greater potential difference between aluminum immersed in copper solutions compared to zinc solutions. This probably causes a higher speed of deposition of copper on aluminum compared to zinc and, consequently, less time for the fluoride anions to completely dissolve the oxide film, the presence of which causes the poor adhesion.

(b) The copper immersion deposit has a greater tendency than the zinc deposit to promote galvanic attack of the aluminum base metal by the solution through the pores in the deposit. The gas and other reaction products from this attack would contribute toward the poor adhesion.



# Sargent's New Finishing Department Exemplifies Close Co-ordination

By Lawrence J. Durney, Ass't Supt. of Finishing, Sargent & Co., New Haven, Conn.

"THE equipment must be replaced and the room re-arranged, but production must be maintained at its present level throughout." This briefly stated was the problem facing Sargent and Company, of New Haven, Conn., one of the country's oldest and largest manufacturers of builders hardware.

In the widespread modernization program under way, attention was being focused on the polishing, buffing and lacquering sections of the finishing department. For several years there had been under consideration a plan for centralizing and completely re-equipping these units for more efficient productive flow. However, production was at an extremely high level and due to the pressure of the production demand it had been deemed advisable to delay the initiation of the program. Early in 1947, however, it became evident that with no foreseeable reduction in production forthcoming, it would be necessary to proceed with the changes while maintaining the productive output of the departments involved.



The Author

Mr. Durney is a graduate of Manhattan College, and since 1942 has held supervisory positions in the plating field with such firms as Remington-Rand, Sulphur Products Co., and Contract Plating Co. before joining Sargent & Co. He has also given talks before several of the Branches of the AES.

At the time the change was to take place, the finishing operations were carried out in three widely separated areas of the plant. Approximately 90% of all lacquering was done by the dip method. The balance was handled with hand spray guns in a small separate room. Power for operation of the lathes was supplied by belts and overhead shafting. In many cases lighting was inadequate and work areas congested.

The re-arrangement program consisted of eight major steps:

1. Transfer of the automatic buffing machines from the basement of one building to the centralized room on the fourth floor of one of the main buildings. This included installation of a new exhaust system and re-design and re-location of the control panels. The exhaust system finally adopted included running the ducts directly from the machines down through the floor into a main duct mounted near the ceiling of the floor below. Provision was also made to separate the exhaust and collection of buffing lint and compound from the polishing exhaust residues.
2. Transfer of the polishing section to the centralized room and replacement of the old belt-driven jacks with motorized lathes and backstand idlers for belt polishing and elimination of set-up wheels. This also included the installation of a new exhaust system and the design and fabrication of special hoods to permit splitting the exhaust on a series of duplex lathes used for both polishing and buffing.
3. Motorization of wet scouring tubs and re-location in the centralized room. This included the installation of a waterproof floor area.
4. Removal of all degreasing and washing tanks, removal of the old water-proof floor and replacement with an automatic spray-dip-spray-vapor degreaser. The degreasing unit is heated electrically and utilizes tetrachloroethylene instead of the more conventional trichloroethylene.
5. Removal of all provisions for dip lacquering, including steam-heated drying ovens and replacement with two automatic spray lacquering machines equipped with two direct gas fired

radiant type ovens for operations to 400°F. This included removal of one set of roof supporting columns and erection of cross trusses to support the roof. The spray lacquer room was also eliminated making way for step 6.

6. Installation of new wash room facilities for the help.
7. Installation of an improved power distribution system to carry the load of the new equipment.
8. Installation of a new lighting system and painting of the entire area.

It was apparent from the very first that the successful completion of the project would require pin-point scheduling and absolute coordination between all departments concerned. To accomplish this, the Process Engineer in charge of finishing was given the responsibility of coordinating and scheduling the entire change. In conjunction with this appointment there was set up a committee consisting of representatives from the production department; the service division (machinists, electrical, plumbing, carpentry and labor departments); the purchasing department; the foremen and supervisors of the department involved; the layout engineer; and the divisional superintendent. These representatives were present at all scheduled meetings and were kept up to date by weekly progress reports originated by the Process Engineer. In addition each member was furnished with sufficient copies of the detailed time-tables for each move for distribution to his help to insure complete understanding by all parties, not only of their functions in the move underway, but also the relation of their jobs to the move as a whole. Both in the weekly reports and in the time-tables it was found advisable to detail exactly all responsibilities. This eliminated considerable duplication of effort. It was also found important to list even the most minute change of plans to permit each department head to evaluate its effect on his scheduled work.

The first stage of the operation was the preparation of a scale template layout of the new arrangement. The use of scale templates permitted better visualization of the proposed arrangement, and rapid change

without the necessity of preparing drawings. The basic floor plan was stapled to a stiff backing board and the templates in turn stapled in any desired position on the floor plan until a satisfactory layout was obtained. The final floor plan print was then prepared from the completed template layout. This was reviewed by all members of the committee and finally submitted for approval to the Works Manager and President of the company. Their approval and authorization put the change underway. Preparations were immediately made to schedule all items and the layout engineer began the task of preparing detailed prints for every phase of every move. This included detailed design of the various exhaust systems, work trays for use in the degreaser and lacquering machines, plans for the waterproof floor, and exact location of each machine for connection of the various service mains.

The purchasing department was first consulted for firm delivery dates on all equipment. This included not only shipping dates, but also shipping routes, times and detailed information on actual arrival times at our plant. This was required not only for scheduling purposes but also to permit preparation of storage facilities where necessary. Next step was to contact the plant engineering department for time estimates on preliminary work and the actual moves. Here again the purchasing department was required to obtain firm delivery dates on such incidental items as wire, switches, bus bar, valves etc. not normally supplied with the equipment. The foreman of each of the service departments were provided with detailed drawing on each phase of work required of them and in turn estimated the number of men and the time required to complete their phase of each project. It was then possible to schedule the move. The pattern for each move was the same:

1. The production department scheduled sufficient overtime work to allow the necessary down time for the move. This overtime work applied not only to the departments involved in the change, but also where necessary the originating departments supplying the parts. A sufficient bank of parts had to be set up in each case to permit

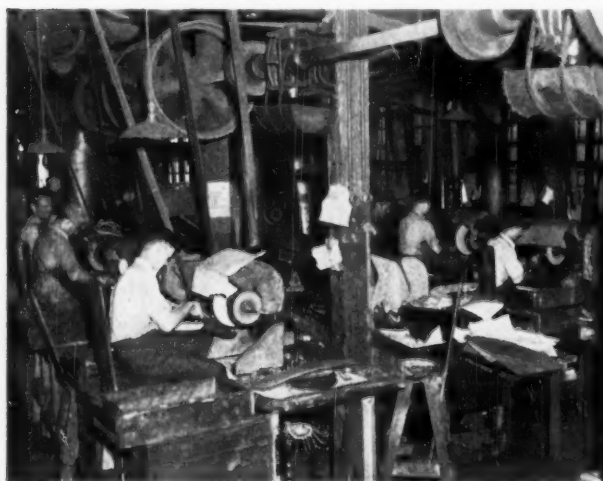


Figure 1. A view of the old buffing section. Note the overhead belts, poor lighting, individual exhaust stacks, and general congested conditions.



Figure 2. Renovated buffing section. Increased work space and better lighting add to worker efficiency.



Figure 3. Installation of conveyor degreaser illustrates magnitude of renovating job.

- the assembly lines to function normally during the changeover.
2. The Service departments arranged to have all preliminary electrical, plumbing and carpentry work completed at least the day before the move.
3. Plant engineering arranged for the necessary outside help to complete the move in the allotted time. In general the outside contractors were consulted for their estimates of required time before the actual scheduling was done.
4. Purchasing arranged delivery of the equipment on schedule.
5. All groups cooperated to make the installation within the allotted time to prevent loss of production.

A complete analysis of every move was essential since many of the components were prefabricated. For example, all dust control systems were completely prepared as much as two weeks ahead of time and assembled on the job; electrical and plumbing lines were in most instances brought to within a foot of the final connection.

On the basis of this analysis, a detailed time table for the move was prepared and distributed. This time table gave detailed instructions as to just what each group was to do, the starting time and the time allowed for each step. One such time table will suffice to describe the system. The installation of the degreaser was scheduled to take place October 18. Beginning October 13, the necessary electrical lines were brought into the area. Necessary materials for the alteration of the water and steam lines were assembled and cut to size. Masons opened the east wall of the building to receive the machine (see Figure 3), and since this wall was to remain open until after installation of the lacquering units, the carpenters set up a temporary closure. The actual installation began October 17. The schedule follows:

OCTOBER 16—Dispatch flat bed truck to New York to pick up machine in time to arrive October 17.

OCTOBER 17—12:00 Noon—Wash operations cease. Buffing sections continue.

12:00 Noon to 3:00 p.m.—All buffed work to be coated with compound to prevent hardening



Figure 4. Wet scouring bench. Water is pre-mixed to lukewarm temperature aiding rinsing and contributing to the comfort of the operator.

of buffing compound. Wash operators to empty tanks and remove auxiliary equipment. Sargent maintenance to clear area.

3:00 p.m.—Contractor to start removing waterproof floor and repair sub-floor. This operation to be complete by October 18, 8:00 a.m.

OCTOBER 18—8:00 a.m.—Plumbers start assembling prefabricated piping. Riggers set machine on base. Manufacturers' welders join frame to machine. Electricians reconnect control panel. Mechanics rig conveyor chain.

10:00 a.m.—Shut off main power supply lines. Lift machine into building.

10:20 a.m.—Re-activate main power lines. Connect to power, steam and water supply.

3:00 p.m.—Trial run.

In only one instance were temporary facilities necessary. The reconstruction of the lacquer room required a minimum of three weeks. Temporary facilities were therefore set up in a small adjoining room which functioned two shifts to maintain production. All other moves were completed on week-ends or by utilizing the week-end plus one productive day.

The changeover was successfully completed only through careful planning and a very marked degree of cooperation from all groups. At no time was there any delay in the heavy production schedule due to these extensive changes in the finishing department, thus the condition stipulated when the changeover was started was fully complied with. In this respect, it should be pointed out that the only major difficulty encountered was in convincing many of the suppliers that exact, detailed blueprints of the equipment were required. Many hours of effort could have been saved if the "detailed" prints submitted had in truth been detailed. The manufacturers, however, were most cooperative in supplying the required detail when the urgency of the need was pointed out to them.

#### Acknowledgments

We gratefully acknowledge the cooperation of Mr. H. R. Giese, Vice President and Works Manager, and Mr. C. L. Phillips, Division Superintendent, for making available the notes and pictures used in its preparation, and for permission to publish this material.



# Electrolytic Polishing of Metallic Surfaces—Part IV

By Dr. Pierre A. Jacquet, *Ingénieur-Chimiste I.C.P., Docteur de l'Université de Paris, France.*

## *Applications of Electrolytic Polishing to the Physical Chemistry of the Metals*

IT HAS been previously stated that the physical chemical methods of study of metals concerns the exterior surface of the sample investigated. It is thus necessary that this surface be characteristic of the metal and that one recognize the microgeometric, physical and chemical states. Mechanical polishing, and even simple rubbing with emery which is much used, are to be rejected because of the disturbance of the crystal structure and chemical contamination. It is quite evident, from the point of view of structure alone, that surfaces such as those represented by Figures 15a, 17b, 17c, 18b, and 18c will have a physical behavior quite different than those of figures 15b, 17 and 18a, which correspond to the normal undisturbed structures. In practice the differences will be much greater, for the micrographs reproduced here do not concern the actual surface layer, but the less deformed adjacent regions. Further, the section represented by Figure 16 shows that a surface subjected to abrasion is very poorly defined from the point of view of microgeometry. Such a surface is no

better defined than that which is concerned with the other physicochemical properties which are not revealed by micrography, such as oxide films and mechanical stresses.

By etching or pickling, the abnormal or superficial zones may often be dissolved, but the microgeometric state of the surface becomes still more badly defined and incompatible with the methods of observation and measurement. Thermal treatment at a sufficiently high temperature, often recommended for the removal of the effects of cold working, does not necessarily reproduce the normal structure of the metal consideration. Figure 14 gives a typical case for brass, for it may be seen that the surface layer now contains smaller crystals than the adjacent layer which has not been deformed during the abrasion.

Consequently, no mechanical or thermal process allows the preparation of useful massive metal surfaces for physico-chemical research. Electrolytic polishing solves the problem, provided that the technique chosen (composition of the bath, conditions of electrolysis, temperature) are well suited.

The principal fields of the physical chemistry of

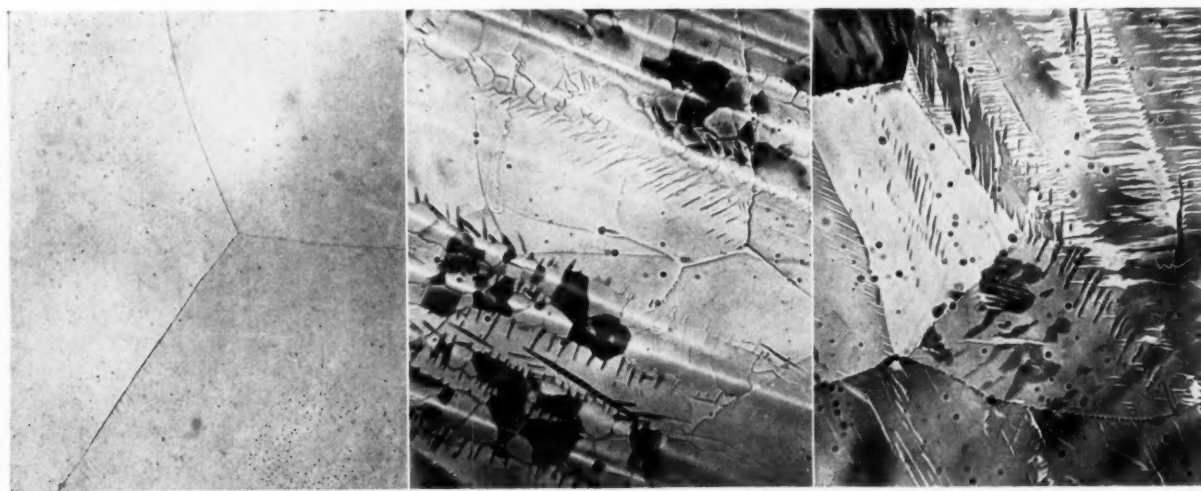


Figure 18. Surface disturbance of structure of pure tin (99.99%) and an alloy of tin and antimony (0.5%) abraded with emery dust paper. All magnifications 85x.

- a) Original surface. The antimony-containing alloy looks the same.
- b) Tin rubbed with No. 6/0 emery paper. Electrolytic solution of a layer of 16 microns. The mechanical twins and small crystals are visible in the remnants of the scratches.
- c) Tin-antimony alloy rubbed with No. 4/0 emery paper. Electrolytic solution of a layer of 16 microns. Twins aligned following the direction of the scratches.



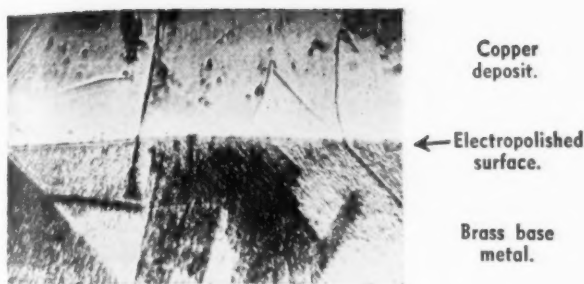


Figure 19. Crystalline continuity of copper deposited from an acid sulfate bath on a 70-30 brass surface polished electrolytically. Section normal to the surface. Micrograph obtained through electropolishing and etching. Magnification 500x.

metals in which investigation is considerably facilitated by the use of electrolytic polishing will be successively reviewed. In many cases comparisons between the properties of surfaces polished by the traditional mechanical methods and the new method will be introduced. The differences observed are explained in the light of the specific properties of the surfaces, essential characteristics of which we have already given but which will be more definitely defined.

#### ELECTRON DIFFRACTION

It is well known that electron diffraction is one of the most sensitive methods for revealing the physical and chemical properties of a surface, and at that, it also allows to a certain extent an approximation of its microgeometry. Many authors have shown that a metallic surface strongly etched chemically gives a characteristic diagram of the metal considered (a pattern of rings if the metal is polycrystalline, a pattern of spots if it is a single crystal). After mechanical polishing the diffraction diagram is composed only of two diffuse rings, the appearance and spacing of which do not vary regardless of the metal. This difference between the appearance of the electron diffraction patterns has generally been interpreted as an experimental demonstration of the presence of an amorphous layer, or "Beilby layer," on mechanically polished metals. However certain investigators arrived at the conclusion that the pattern of diffuse rings was due to the presence of a very thin superficial film of oxide formed during the polishing with abrasives in the presence of air and moisture.<sup>19</sup> Even though the exact nature of a mechanically polished surface is still under controversy, there is a tendency to reject the theory of Beilby and admit that the surface layer is composed of extremely fine microcrystals.<sup>20</sup>

Electrolytically polished surfaces have been examined and analyzed by means of electron diffraction. The first results, which were obtained under rather poorly defined conditions with respect to the composition of the electrolyte,<sup>21</sup> the manipulation of the specimens and their removal from the bath,<sup>22</sup> have shown the presence of a layer of oxide. Recent research in which the details of operation are known<sup>23</sup> have proven, to the contrary, that metals such as copper and aluminum polished electrolytically in certain baths give a diffraction diagram characteristic of the pure metal without any disturbance of



Figure 20. Taper section in a specimen of carbon steel, the surface of which was sanded with No. 0 emery paper then electropolished 8 minutes in acetic-perchloric bath. Horizontal magnification 1000x; Vertical magnification 4000x. Note absence of disturbed zone. Specimen electropolished and picral etched.

the crystal structure or films of oxides or other chemical compounds.

The characteristic diagram of a pure metal is rather surprising in the particular case of aluminum (Figure 21) considering its well known ease of formation of an oxide film on contact with air or water. More surprising is the fact that polished aluminum exposed to the air for several weeks always shows the diagram of the metal and not the oxide: the diffraction spots only become less intense but the characteristic rings of alumina do not appear. It is only after several days immersion in water that the pattern of the oxide becomes visible. These results will be discussed later and compared with those obtained by measuring the potential of solution.

An important remark should be made concerning the composition of the polishing bath. The observations reported above refer to aluminum polished in acetic-perchloric electrolytes.

Metal polished in the industrial phosphoric-chromic acid baths<sup>24</sup> do not give as clear a diagram; the spots are less intense with respect to the background and it may be estimated that the surface is covered with a film of oxide measuring about 50 to 80 Angstroms in thickness.

Electron diagrams furnished by metals polished

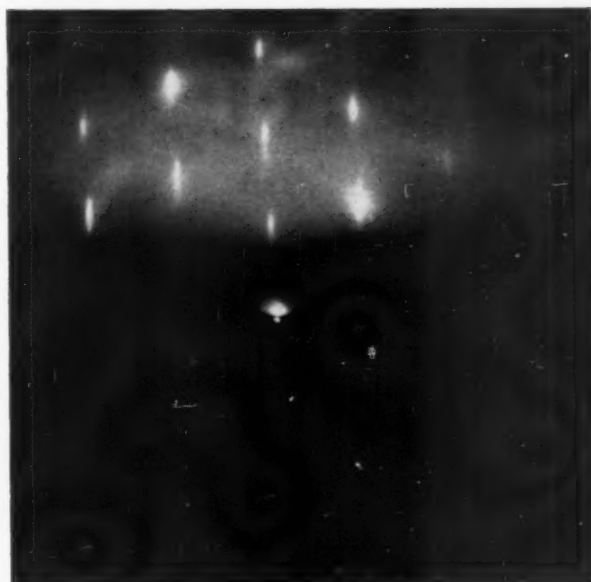


Figure 21. Electron diffraction diagram on the plane of a monocrystal of aluminum electropolished in acetic-perchloric bath. The clarity of the diffraction spots and Kikuchi lines indicate the perfection of the crystal structure of the surface.

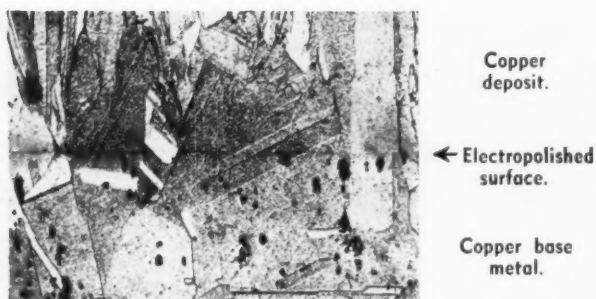


Figure 22. Electrolytic deposit of copper from an acid bath at 9.3 A/ft.<sup>2</sup> on an electropolished copper cathode. Section normal to surface. Crystalline continuity between the deposit and the base metal. Micrograph obtained by electropolishing and etching. 250x.

electrolytically show a particularly interesting point; the diffraction spots do not possess the normal round form but are elongated in one direction (Figure 21) which is explained by a phenomenon of refraction of incident rays<sup>25</sup>, and it may be deduced that the surface is very slightly wavy, with ridges of the order of a few interatomic distances.

By dissolving the layers covering a metal subjected to abrasion, through a series of anodic polishings, and examining the electron diffraction pattern after each treatment, it is possible to define the structure of the disturbed layer. A schematic diagram of the results is given in Figure 12, and it agrees well with the micrographic observations, a few examples of which were given previously.

In conclusion, electron diffraction contributes a certain proof that metallic surfaces polished electrolytically under the appropriate conditions are very smooth, have the normal structure of the metal and are practically free of all chemical impurities. Their microgeometric, physical and chemical properties are well defined and reproducible.

#### DIFFRACTION AND DIFFUSION OF X-RAYS

The structural transformations caused by abrasion of metallic surfaces may also be studied with X-rays by means of the back reflection technique. *Benard & Lacombe*<sup>26</sup> have shown that a monocrystal of iron or aluminum which normally gives a diagram of spots, shows a pattern of rings after abrasion with emery paper. This type of diagram is typical of a polycrystalline aggregate. By dissolving the layers across the metal through anodic polishing, a point occurs

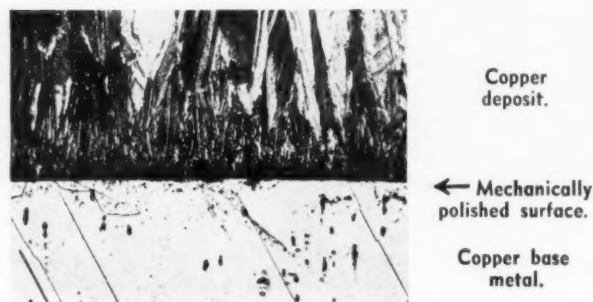


Figure 24. Copper deposit from an acid bath on a mechanically polished cathode of copper. Note absence of crystalline continuity. Compare with Figure 22. Magnification 250x.



Figure 23. Crystalline continuity of a lead deposit on a lead cathode. This is a section of a cathode from a refining cell using a sulfamate bath. Micrograph obtained by electropolishing and etching. 760x.

where the diagram of a monocrystal is again observed. The amount of metal which must be removed to obtain this result is different with iron and aluminum and varies also according to the conditions of abrasion: for pure iron, rubbing with number 2 emery paper (coarse grain) gives a division of the monocrystal into small crystals which extends to a depth of the order of 70 microns. X-rays have also shown a specific orientation of the small crystals starting at a certain distance below the surface.

The diffusion of X-rays by aluminum surfaces differs according to whether the metal has been mechanically or electrolytically polished. The degree of diffusion is much greater in the former than in the latter,<sup>27</sup> and this is also explained by the fracture of the metallic crystals subjected to abrasion into very small crystallites.

The micrographic method devised by *Barrett*<sup>28</sup> using the diffusion of X-rays should also be noted. This method requires very flat surfaces whose structure has not been modified by mechanical action during the preparation. Electrolytic polishing has given complete satisfaction here.

Finally, the new polishing method has been used to make thin the samples to be examined by the microradiography technique.<sup>29</sup>

#### OPTICAL AND CRYSTALLOGRAPHIC PROPERTIES

It is easy to prove that the electrolytic polishing

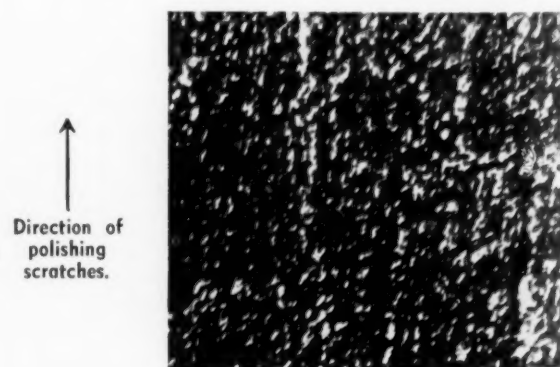


Figure 25. Surface of a copper deposit from an acid sulfate bath (52 mins. @ 0.65A/ft.<sup>2</sup>) on a mechanically polished copper cathode. Polished 3 hrs. on a chamois with alumina. Photograph taken in the bath during the progress of the electrolysis. Compare with Figure 27a which corresponds to a deposit of the same thickness on an electropolished surface. Magnification 250x.

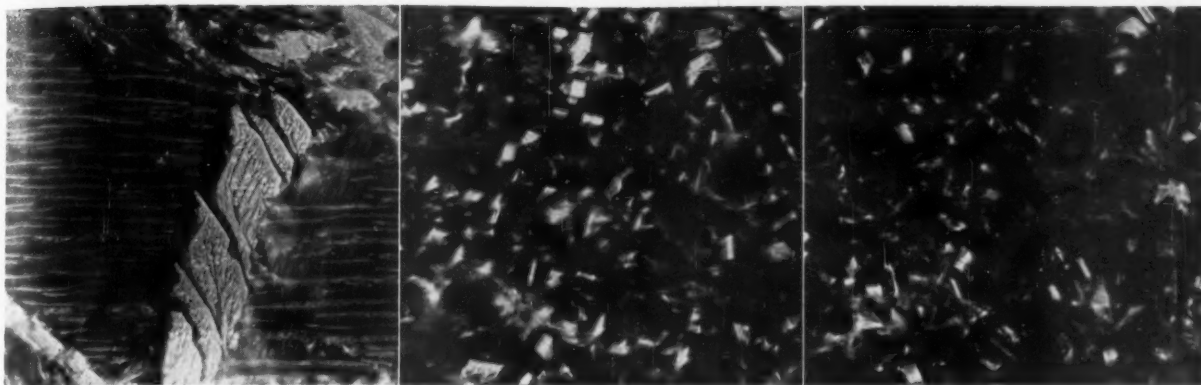


Figure 26. Surface of cathodic copper deposits ( $3\frac{1}{2}$  hrs. electrolysis in an acid sulfate bath at  $4.65A/ft.^2$ ) obtained on a copper cathode. All magnifications 500x.

- a) Electropolished cathode.  
b) Electropolished cathode covered with an adsorbed layer of serum albumen.  
c) Mechanically polished cathode.

method gives a superior brilliance to a metal than that of the best mechanical polishing. Starting in 1936 English physicists<sup>30</sup> compared the brilliant and smooth surfaces of copper obtained by three methods, by means of a very accurate method. The surfaces were prepared by a) mechanical polishing; b) electrolytic polishing in orthophosphoric acid; c) condensation under vacuum. They observed the following results:

1. The optical constants are more easily reproducible with metal polished electrolytically.
2. For all wavelengths of incident light the ability to reflect is greatest in the case of electrolytically polished surfaces. See Table I.

TABLE I

*Light Reflection of Copper Surfaces*

	Reflection	
	4800 A°	6800 A°
Mechanical polishing	48%	90%
Electrolytic polishing	58%	97%
Mirror condensed under vacuum	49%	92%

In collaboration with Professor L. Capdecombe these results have been confirmed<sup>31</sup> and it was also established that pure aluminum electrolytically pol-

ished in acetic-perchloric acid shows a constant reflectance, within the limits of precision of the measurements (about 1%) not only at different points on the same sample but also on a series of specimens prepared independently under the same conditions. Quite the contrary, the traditional micrographic polishing gives a reflectance which varies on the same surface as well as between one surface and another.<sup>32</sup>

Capdecombe and his collaborators<sup>33</sup> have made many studies of the optical properties of metallic crystals in normal and polarized light. For all of the metals studied, isotropes (aluminum, copper) and anisotropes (zinc, cadmium, tin), correct measurements were only possible with electrolytically polished surfaces. The results are inconsistent with mechanically polished surfaces which are always covered with oxide films or other chemical impurities. For this reason many of the results published in the literature should be considered valueless.

ELECTROCHEMICAL PROPERTIES

Metallic surfaces prepared by electrolytic polishing methods show quite different electrochemical properties from those of surfaces prepared by the other methods of polishing. The results obtained in the study of these properties tends to show that for fundamental research on corrosion and cathodic plating processes,

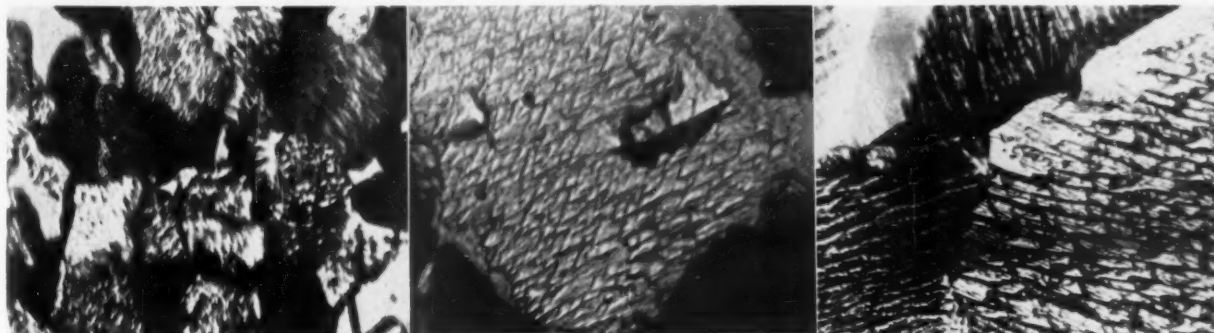


Figure 27. Surfaces of cathodic copper deposits obtained from an acid sulfate bath on electropolished cathode.

- a) Photograph taken in the bath during electrolysis (55 mins. @  $.65A/ft.^2$ ). 250x.  
b) Photograph taken after electrolysis (60 mins. @  $.93A/ft.^2$ ). 750x.  
c) Photograph taken after electrolysis (39 hrs. @  $.46A/ft.^2$ ). 500x.



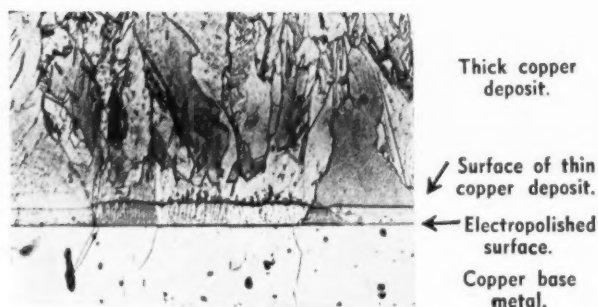


Figure 28. Section perpendicular to the surface showing the crystalline continuity through a copper deposit from 39 hrs. @ .46A/ft.<sup>2</sup> on an electropolished cathode. The surface structure of this deposit is shown in Figure 27c. Notice the varying thickness of deposit on the different crystals of the base metal. Micrograph (250x) obtained by electropolishing and etching.

it is necessary to abandon the usual techniques for the preparation of the samples and use a properly chosen electrolytic polishing process. This conclusion will be illustrated by a few typical examples.

### Solution Potential

It is known that the equilibrium potential, obtained from a metal immersed in a solution of one of its salts, expresses a well defined thermodynamic concept. On the contrary, the potential of solution, that is the potential taken by the metal immersed in a medium either acid, basic, or neutral, is not reversible. This potential varies in the course of time, for the surface itself does not remain the same. It is modified because of the appearance of the reaction products of the metal and the electrolyte. This is why the solution potential may be a measure of the activity of the metal, and is important to know as an explanation of the processes of corrosion.

It is evident that the value of the solution potential of a metal is very sensitive to all of the characteristics of the surface. Until now this value has been determined experimentally on mechanically polished or

chemically pickled surfaces, or in other words with very poorly defined surface properties.

Professors *G. Chaudron*, *P. Lacombe* and *P. Morize* wisely considered the use of anodic polishing to prepare surfaces for the measurement of solution potential.<sup>34</sup> They have obtained results of great value with very pure (99.99%) aluminum.

The literature states that the potential of mechanically polished aluminum is 0.500 volts in distilled water, and 0.550 to -0.800 volt (according to the authors) in a 3% aqueous solution of sodium chloride. The acceptance of these values led to an anomaly in the classification of metals, for aluminum was found to fall after zinc (solution potential about -1.00 volt) although the chemical reactivity of aluminum is much greater than that of zinc (i.e. the heat of formation of aluminum oxide and zinc oxide are 380,000 and 85,000 calories respectively).

*G. Chaudron* and his co-workers have found that electrolytically polished aluminum (acetic-perchloric bath) in distilled water and in sodium chloride solution takes a value of the order of -1.200 volts, clearly more negative than the accepted value. Also the anomaly in comparison with zinc mentioned above disappears. The authors have also shown that the most negative value is only obtained if the specimen is washed with organic solvents (acetone, absolute alcohol) starting with its removal from the polishing bath. Washing with water gives a less negative value (-1.00 to -1.100 volt).

If the polished surface is dried and left in contact with the air for some time before the measurement of the potential, the value obtained is all the less negative as the time in contact with the air is longer, and as the air contains more water vapor. The method has been developed sufficiently sensitive to allow the study of the speed of oxidation of aluminum under different conditions (see later under corrosion).

It is worthy of note that the potential towards which anodically polished aluminum left standing in ordinary

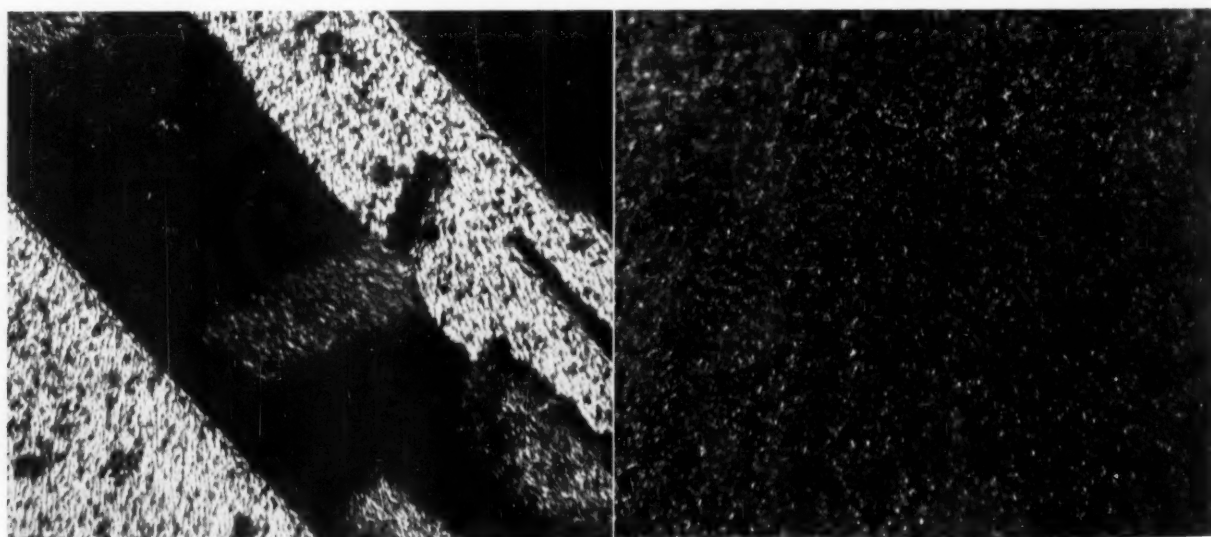


Figure 29. Copper deposit from a cyanide bath (25 gm/l. copper cyanide-30 gm/l. sodium cyanide-18 gm/l. sodium carbonate) on an electropolished copper cathode. Magnifications 500x.  
a) Electrolysis for 8½ hrs. at .23A/ft.<sup>2</sup>. Thickness of deposit about .00011". The deposit continues the structure of the base metal.  
b) Electrolysis 2 hrs. at 1.02A/ft.<sup>2</sup>. Thickness of deposit about .00011". The deposit is micro-crystalline.



air goes, is the same as the potential of mechanically polished metal ( $-0.70$  to  $-0.800$  volt). This proves that it is the film of oxide present on mechanically polished aluminum which is responsible for the abnormal solution potential measured with this state of the surface.

We suggested to *H. Raether* that he determine the relation between the solution potential and the thickness of the film of oxide present on the surface of the aluminum. The important point was to know whether the most negative potential ( $-1.200$  volt), measured with an electrolytically polished surface, corresponds in reality to bare metal without a film of alumina. *Raether* studied a series of pure (99.995%) aluminum samples, both electron diffraction diagrams (by reflection), and the solution potential in a 3% sodium chloride solution. The samples contained three types of surface: a) surfaces polished electrolytically and examined immediately after polishing; b) surfaces polished electrolytically but left in contact with air or water for different times before examination; c) surfaces polished electrolytically then covered by means of anodic oxidation (in sulfuric acid), with films of alumina of controlled thickness varying between  $10$ — $100\text{\AA}$ . These studies have given the following results.<sup>35</sup>

- 1) The surfaces immediately after polishing had a potential in the vicinity of  $-1.200$  volt, in agreement with the data of *Chaudron*. The electron diffraction diagram is characteristic of aluminum crystals which are undisturbed, smooth and without oxide (very brilliant elongated spots and *Kikuchi* lines Figure 21).
- 2) After exposure to the air for 10 to 40 days, the solution potential is about  $-0.760$  volt. The electron diffraction pattern is little different from that of the specimens examined immediately after polishing. In effect, the spots due to the aluminum are always very clear, but the background is a little duller. By comparison with the diagrams given by the anodically oxidized metal, the films of alumina are estimated to be from  $30$  to  $50\text{\AA}$  in thickness.
- 3) After leaving aluminum in distilled water for a few days the samples show a voltage of  $-0.760$  volt. The corresponding electron diagrams here show a decided change: the spots of aluminum are no longer noticeable, the continuous background is very intense and it sometimes exhibits the characteristic rings of  $\text{Al}_2\text{O}_3$ .

From these results it may be concluded that the solution potential is much more sensitive than the diffraction diagrams to the presence of thin films of aluminum oxide. On the contrary, when the thickness of the films increases on contact with the air or water, the potential remains constant at  $-0.760$  volts but the appearance of the electron diffraction diagram changes.

Contrary to general opinion, the reflection method of electron diffraction is not very well adapted to the detection of small quantities of chemical impurities on metals. Further, the very plane microgeometry of electrolytically polished surfaces is an unfavorable condition for this detection.

These experiments of *Raether* do not allow the confirmation of the fact that the most negative potential given by aluminum immediately after its removal from the polishing bath is that of a surface absolutely free of alumina. It is quite probable, on the contrary, that from the first instant of contact with the external medium, the electrolytically polished aluminum is very quickly covered by a film of oxide or perhaps a layer of adsorbed oxygen molecules. According to the electron diagrams, this layer or film would have a maximum thickness of the order of about  $20\text{\AA}$ . It is curious that this thickness increased only very slowly ( $50\text{\AA}$  after 40 days exposure to the atmosphere), which proves that the layer of passivation is very continuous in spite of its limited thickness. The flatness of the surface and the exposure of the pure metal are probably the causes of the special behavior of electrolytically polished aluminum, which behavior is of considerable importance from the point of view of corrosion, as will be shown later.

The details of electrolytic polishing technique should be stressed, as they have a definite effect upon the chemical nature of the surface. Some processes are known to give layers of passivation which are relatively thick. (Brytal and Alzak processes for aluminum, Battelle Memorial Institute process for stainless steel, etc.). *Raether* has observed that polishing of aluminum in an industrial type electrolyte (solution of phosphoric and chromic acids)<sup>24</sup> gives a surface with a solution potential the same as that of aluminum oxide ( $-0.760$  volt) when measured immediately after removal from the bath, and at the same time the electron diffraction pattern quite often contains the spots of oxide, although not very clear. It may be assumed that in this case the film of oxide on the surface measures  $50$ — $80\text{\AA}$ .

#### *The Formation of Cathodic Deposits on Electrolytically Polished Surfaces*

Knowledge of the processes of formation of electrolytic deposits of metals on surfaces is of both scientific and practical interest. Certain important technical properties of these deposits (adhesion, internal pressure, crystalline state, porosity, etc.) are not only influenced by the composition of the bath and the conditions of electrolysis, but also by the nature and characteristics of the surface of the cathode.

It is known that the "crystalline continuity" phenomenon of an electro-deposit and its metallic support is only observed if the two metals are identical or if they possess quite similar crystal networks. Furthermore, it is necessary that the surface of the cathode be chemically clean and bright. Figures 22 and 23 show the crystalline continuity of a copper deposit on a copper cathode and of a lead deposit on a lead cathode. This phenomenon, which is a condition of very good adhesion, is shown as in Figures 22 and 23 in a section normal to the surface of the cathode. Knowing that it is the first seeds deposited on the surface of the support which are responsible for the continuity of structure, it is quite tempting to study the phenomenon, not by a section through a very thick deposit, but by direct observation of the surface during the first

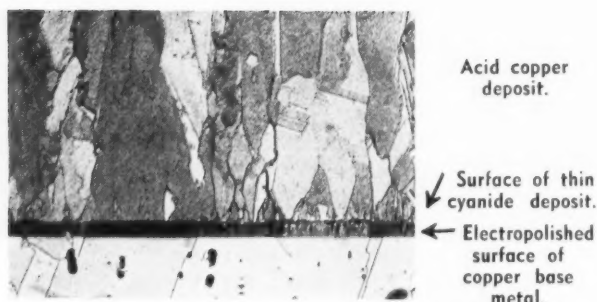


Figure 30. Section perpendicular to the surface showing the crystalline continuity across a deposit of copper from a cyanide bath (40 hrs. @ .23A/ft.<sup>2</sup>) same current density as Figure 29a. Electropolished copper cathode. Micrograph (250x) prepared by electropolishing and etching. Compare with Figure 28 which shows a deposit of copper from an acid sulfate bath.

stages of deposition. Before the discovery of electrolytic polishing these experiments would have been very difficult, if not impossible, for optical examination of a surface requires that the surface be very well polished. It is known that, in the case of a mechanically polished support, the crystalline continuity does not exist (Figure 24) and observation under a microscope during the start of electrolysis shows that the seeds are formed at random over all of the surface and at first prefer the striations from polishing. (Figure 25). These seeds then grow to give an infinite number of crystals (Figure 26c) without relation to the structure of the mass of the support. This is the normal result on the superficially disturbed layer from mechanical polishing. If it is assumed that the surface thus polished does not contain a film of oxide, or other chemical impurities, it may then be assumed that the crystalline continuity exists between the superficial crystallites resulting from the fragmentation of the large adjacent crystals. On the other hand, there are large crystals on an electrolytically polished surface which are not disturbed. We may thus easily observe the appearance of the first seed deposited on such a surface, or study the growth of each crystal of the cathode.<sup>36</sup> The method consists of photographing the cathode at different periods in the electrolysis. An arrangement mounted on the stage of a metallographic microscope allowed observation and photographing without interrupting the passage of

electric current. However, the pictures thus obtained are not very clear because of the layer of electrolyte and the wall of the bath interposed before the objective of the microscope, and are limited to low magnifications. For more exact examination it is necessary to remove the sample and photograph it directly.

We have conducted a large number of experiments with an anodically polished cast copper cathode and plating baths of various compositions (acid copper sulfate, alkaline copper cyanide, nickel sulfate, cadmium cyanide, silver cyanide) electrolyzed under variable current density conditions. As examples, we will describe a few of the results.

Figure 27a shows the surface of a cathode photographed in the acid copper sulfate bath after 55 minutes electrolysis at 70 mA/dm<sup>2</sup> (0.65 A/ft<sup>2</sup>). The different crystals, each one of which presents a different internal structure may be distinguished. Details of this internal structure are visible in Figures 15a, 16b and 16c, which are micrographs taken at high magnification. It may be seen that each crystal is composed of plates of which the orientation, spacing and form is constant for each crystal but which vary from one crystal to another. It is remarkable that these details are still visible after a long period of electrolysis giving a relatively thick deposit (about .00078 in. in the case of Figures 26a and 27c). The structure thus revealed illustrates the regular growth of each crystal of the cathode, or the phenomenon of crystalline continuity. This is easily shown by examining a section perpendicular to the surface. For example, Figure 28 shows a section of the deposit viewed from the surface in Figure 27c. In order to obtain this section the thin deposit was covered with a thick layer of copper. The fact that both deposits reproduce the copper crystals of the base is good proof of crystalline continuity. In Figure 28 it is clearly seen that the first thin deposit does not have a constant thickness: some crystals grow more rapidly than others, or in other words the growth is a function of the crystallographic orientation. These differences of speed of growth are very clear at low current density and disappear when the current is increased, but even at high current density the internal structure is still visible (Figure 26a). Analogous results have been obtained by *Gwathmey* and *Benton* in

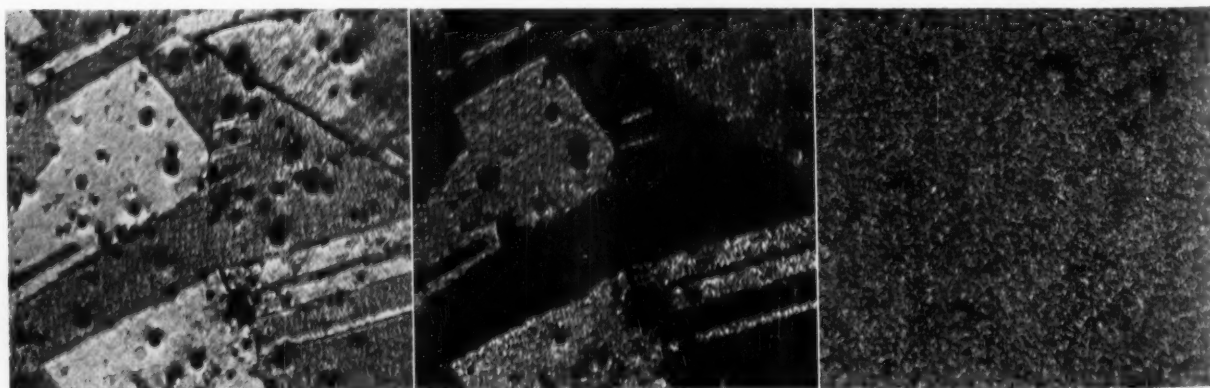


Figure 31. Electrodeposits of nickel from a sulfate bath (NiSO<sub>4</sub>, 250 gm/l.-NiCl<sub>2</sub>, 30 gm/l.-20 gm/l. boric acid) on an electropolished copper cathode. Magnifications 250x.

- a) Photographs taken in the bath during electrolysis at 1.3A/ft.<sup>2</sup> for 57 minutes.
- b) Same after 6½ hrs. Deposit about .0004" thick.
- c) 12½ hr. deposit at .56A/ft.<sup>2</sup>. Deposit thickness about .0003".

their studies of the electrolytic growth of anodically polished copper monocrystals.<sup>37</sup>

The internal structure of growing crystals shows a great similarity to the reverse process of chemical or electrolytic solution: etching a crystal causes the appearance of designs (plates, striations, etc.) which are called "figures of corrosion" and which are also characteristic of the crystallographic orientation of the crystal under consideration. It is also known that some crystal faces are more quickly attacked than others.

It has been stated that electrolytic deposits of copper obtained from complex cyanide baths (copper cyanide and sodium cyanide) are composed of very small crystals, which do not exhibit the phenomenon of crystalline continuity of a copper cathode which is composed of large crystals. Actually, if the electrolysis in a complex cyanide bath is done with a very low current density, 25 mA/dm<sup>2</sup> (0.23 A/ft<sup>2</sup>) we have established that the appearance is quite similar to those obtained with an acid bath. The specific internal structure of each crystal of the cathode (Figure 29a) which is characteristic of crystalline continuity may also be seen on the surface. Furthermore, a section perpendicular to the surface shows this continuity very well (Figure 30).

The results are quite different if the current density has a higher value. A deposit of the same thickness as the former but obtained at 110 mA/dm<sup>2</sup> (1.02 A/ft<sup>2</sup>) no longer shows the large crystals of the cathode, for these do not grow but are covered with a large number of small crystals (Figure 29b). This is the normal structure always attributed to deposits obtained from complex cyanide baths, and certainly the crystalline continuity does not exist. We have established that the crystal growth at the cathode stops when a current density value which corresponds to the appearance or evolution of hydrogen is reached. The hydrogen atoms impede the copper atoms by being discharged on all of the active centers of the crystal network of the cathode; certain of these centers are inhibited by hydrogen and thus the crystalline continuity is no longer possible: the deposit becomes microcrystalline.

Inhibition of the active centers of the cathode may also be realized with acid copper sulfate baths when a small amount of organic colloid (gelatin, serum albumen) is added to them. A single adsorbed layer of the colloid inhibits the growth of the cathode in a pure acid sulfate bath and produces a deposit identical with that formed on a mechanically polished surface. In order to produce this inhibition it is sufficient to immerse an electrolytically polished surface in a dilute solution of serum albumen for five seconds, then wash copiously with water before placing the cathode in the acid baths.\*

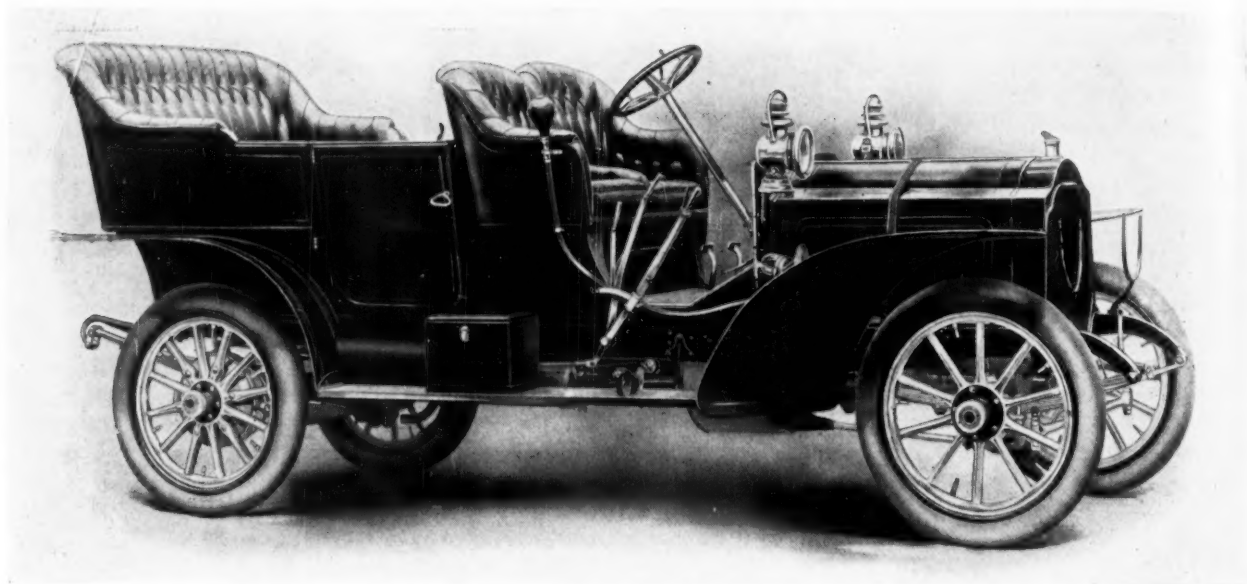
\* The serum albumen concentration is 0.120 g./l. We have confirmed that immersion in distilled water for five seconds and then prolonged washing has no effect. It would be expected that these operations would oxidize the surface and that this layer of oxide would impede the crystalline continuity.

The deposit is then microcrystalline (Figure 26b), quite different from those obtained in the same bath, with the same current density, and for the same time on a cathode of the same nature, but without an adsorbed layer of albumen (Figure 26a). On the contrary, it is noticed that the layer has a rather complete similarity with one of the same thickness formed on a mechanically polished surface (Figure 26c). The colloid adsorbed on the crystal network of the cathode thus hinders regular growth and incites the formation of new independent crystals, which then grow normally. If the colloid is present in the bath the inhibition is produced all through the electrolysis. The seeds, not being able to grow, are being constantly formed and the deposit is extremely fine like those formed in complex cyanide baths in the presence of hydrogen gas. It is possible that the brightening agents in plating baths act in the same manner. The inhibition of the active centers by a single adsorbed layer on the cathode is of great practical importance for it may be produced under industrial conditions as a result of poorly cleaned surfaces which may retain layers of chemical impurities (grease for example). This will result in poor adhesion of the deposit.<sup>38</sup>

In the same manner we have studied nickel deposits from acid sulfate baths, on copper. The current density acts in the inverse way to that observed with copper in an alkaline bath. At very low current densities the deposit is microcrystalline and does not follow the structure of the cathode (Figure 31c). It is accompanied by a noticeable evolution of hydrogen. At higher current densities a thick deposit seems to reproduce the grains of the support (Figure 31a and 31b), but in reality the internal structure does not show the characteristic pattern of crystal growth. Here is found the phenomenon of pseudo-crystalline continuity which is difficult to interpret, but it seems to be related to the evolution of hydrogen, which although less appreciable at low current density, is not absent and thus inhibits certain reactive centers of the network. Furthermore, the dimensions of the fundamental network of nickel differ from those of copper.

In conclusion, we may say that electrolytic polishing of surfaces used as a cathode makes possible the study of thin deposits and shows phenomena of practical interest, such as the influence of the composition of the bath, the conditions of electrolysis, and the effect of superficial impurities on the formation of the first seeds, crystalline continuity, and adhesion. These fields of application are still little explored and it is for this reason that we have given a few details on the principle of the method and the results which may be obtained. Further, it seems that electrolytic polishing has given an excellent method of preparation of surfaces for practical metal plating, for it lays bare the base metal and thus eliminates the layer of abnormal structure and chemical impurities which are the cause of poor adhesion and porous deposits. These details will be discussed more fully in connection with the industrial application of electrolytic polishing.





## All Our Yesterdays—Part XI

By Frederick A. Lowenheim

FOR reasons best known to himself, the editor of this estimable journal has requested the author of these *recherches du temps perdus* to give his right name. At the risk of losing whatever friends I may have in the trade, I comply with the request and thus emerge from obscurity, as may be seen by noting the authorship at the heading of this article. But in part payment for thus exposing myself on the firing line, I must be allowed to explain, for a reason which will appear presently, how I happened to choose the pseudonym *George Spelvin*, above which the previous articles in this series have been published.

The title of this series will be recognized as being derived from the theater—more specifically, *Macbeth* Act V Scene 5:

Tomorrow, and tomorrow, and tomorrow  
Creeps in this petty pace from day to day,  
To the last syllable of recorded time;  
And all our yesterdays have lighted fools  
The way to dusty death.

Thus it seemed appropriate that my *nom de plume* have theatrical significance also. Those versed in such matters will know that when the program of a play credits the acting of a small part to one *George Spelvin*, there really is no such person: he is a figment of the producer's imagination, designed to conceal the fact that several different bit roles are played by the same actor.

So much for my sources. Now why my insistence on this explanation? Well, several of my friends who knew my awful secret have accused me of petty plagiarism, of stealing the name from one of *Westbrook Pegler's* favorite characters. My alarm and dismay at the realization that my mind and that of Mr.

Pegler were working, even momentarily, in the same channels can be, as they say, better imagined than described. I was unaware of Mr. P's *dramatis personae*. Under the circumstances I can only deplore the coincidence.

And now to brass-plated tacks, and the trade journals of 1913.

The automobile industry was becoming of increasing importance to the electroplater. One editor's view of what was in store:

"The job plater has obtained comparatively little business in the past from the automobile owner. The lamps and hardware have been of brass with no plating on them. While some of the smaller parts have been brass plated, they have rarely been brought to any plater for refinishing, but a coat of black paint has been given them. The future, however, will see a different condition; the trade demands that all lamps and parts which were previously left in the natural brass finish, shall now be nickel plated, and a car that is without this finish looks out of date. Not only will the original nickel gradually become tarnished, but it is apt to peel, and these two things will react to the benefit of the job plater in every town . . . Sooner or later they find their way to the job plater. The peeling of the nickel deposit from the nickel plated parts of an automobile is, we regret to say, far more common than it should be. This condition is more apt to be the case with nickel plated steel parts than with those of brass. Steel will be more largely used on cheap cars than in the past, for parts previously made of brass. Some of the makers of high-grade cars are now silver plating their lamps and hardware.

and this will have equally as good an influence upon the jobbing plating trade, for they will require attention sooner or later."

Constant readers of this series will recognize certain themes which recur throughout the individual installments, giving a rather symphonic effect. One of these leitmotifs is the potassium vs. sodium debate, which according to the writer of the following lines was just about settled:

"It was in December 1910 that the use of sodium cyanide in electroplating was first brought to the attention of the trade through the columns of this journal. It is believed that this was the first time mention had ever been made of the subject." (One is tempted to comment sarcastically on such a sweeping priority claim, but somehow any comment I can think of seems pale beside the bald statement itself.)

"In a short time after the previously mentioned article appeared, platers began to use sodium cyanide in an experimental way, and like many other new materials, it was condemned by many. Not all persons are capable of experimenting, and this was the case with some of the platers who tried out sodium cyanide; the result was that a diversity of opinions followed.

"To-day all is changed and it is difficult to find a plater who is averse to sodium cyanide. Much of the early difficulty with sodium cyanide was caused by the fact that it is much stronger than the other cyanides.

"Sodium cyanide has now stood the test of time. So far there have been no dissenting voices, as far as those who are capable of judging are concerned."

In 1913, as in 1949, the plater was offered his choice between standard bath formulations using technical chemicals under their right names, and proprietary compositions which were usually designated simply as Blank's Super-Duper Nickel Salts. There, however, the similarity between today and yesterday ends, for the old-time plater discussed his opinion of Mr. Blank and his salts pretty freely in the trade journals, and if his opinion was uncomplimentary, so much the worse for the Blank Co. And that was true even if Blank Co. was a regular advertiser! It all fitted in with a franker, more argumentative and much less polite era in journalism which was even then drawing to a close. Let us glance at some of this correspondence and editorial comment regarding some controversial nickel-plating salts. We quote them here at some length, without comment.

Letter to the editor: "As a reader of your paper I have noticed quite a number of advertisements lately relating to the new nickel salts that are being placed in the market . . . Today I am in receipt of a letter and pamphlet from ——— Company, discribing [sic] a German product which they claim surpasses any salt on the market. It might not be any better than the salts we are using, as was the case with the 'Red Copper Compound' which they advertised a few years ago and which we found to be no better than the copper carbonate we used at the time, and which we still prefer to use after giving their product a fair trial.

"Being unfamiliar with these salts, I should be pleased if you could advise me regarding same. If they are superior to salts we are using at the present

time, no doubt we will have to use them, but if they do not accomplish all that is claimed for them, we should be unwilling to use them, especially as the price is quite high."

Editor's reply: "Judging from the reports that we see and hear, there are numbers of platers who have tried and are trying out all of these various compounds mentioned by our correspondent. We know that some have had very good results while others may have encountered difficulties. This would be a good time for each to tell of his experiences. The good reports will help our correspondent and the manufacturers, while the unfavorable ones may offer opportunities for explanations and the righting of misunderstandings . . . We invite replies from both manufacturer and plater."

The editor had time to sleep on the questions and the next month had more to say: "We published last month a communication from a reader who wanted information regarding the various nickel plating salts and other platers' compounds on the market. In this issue we publish the story of the manufacturer of some of these compounds. We think that in this way some disputed and misunderstood points and questions may be cleared up to the satisfaction of all concerned. If an intending purchaser would tell manufacturers just what he required and expected of certain compounds and for what purpose he desired to use them, we have no doubt that in ninety cases out of one hundred no trouble would result. The other ten cases may be put down to misinterpretation of directions.

"Apropos of the above a subscriber wrote us for a formula, which was sent him. In a month or so he wrote, stating that the formula was absolutely no good and that he had been put to considerable expense through bad work caused by its failure. Visions of damage suits passed before the eyes of the editor until he noticed the last line of the letter which said, 'I used nickel anodes.' As the formula given out specially stated to use brass anodes and not nickel, it is easy to read the answer to that puzzle!

"These are the points which keep manufacturer and consumer at odds. It seems a bit unreasonable for a consumer to doubt statements made by a manufacturer who has spent years of time and lots of money to discover just those mistakes that he is trying to help the user to avoid. There is no doubt but that the advertisers mean what they say. We believe that they do and we believe also that they know what their goods will do and that they are as a whole conservative rather than exaggerative."

The manufacturer has his innings: "As we are also readers of your valuable paper pertaining to the metal industry we have noticed the communication published in your issue of March signed by the 'Plating Works.' In Justice to ourselves we are compelled to take issue with these parties in regard to our red copper compound. It seems very amusing to us that a concern who has only used 10 pounds of this material, purchased here March 9, 1907, and again another order of 15 pounds, purchased August 1, 1907, would try to act as judges and criticise the value of this material, having only tried it in a small experimental way. We

today have some of the largest users of red copper compound on our books who have continually used the same for almost nine years. Their orders come in here regularly and they simply would not do without it.

"As regards our new Nickel Salts, time will tell what kind of an article we have, as we are leaving it to the consumer and a large number of houses who have used this article in the last two months have willingly paid their invoices, although the goods were all sent on approval to be shipped back at our expense. We had a few complaints where our customers made their solutions entirely too heavy, wasting the material, and also the bath would crystallize. We have in this city during the last two weeks seen some wonderful results procured by this process and we do not intend to tell our friends to try these goods unless they try them on approval."

The importer of a competing brand of nickel salts decided to get into the act: "I note a communication . . . asking for information relating to the various new nickel salts that are being placed on the market. As for the line of nickel plating salts which I represent in this country, I should be pleased to have you publish a few of the indorsements and testimonials which have been received by me during the past few weeks." There follow about twenty fulsome letters of praise.

One communication to the editor was pointed: "In compliance with your invitation for platers who have tried the new nickel salts which have been advertised so much, to give their experience, I want to say for the benefit of the ——— Plating Works, and others, that I have tried their salts, and do not find them superior in any way to the ordinary double nickel salts. I do not think a single claim that the dealers make for them can be substantiated."

In the next issue the editors had another letter on the matter. "Before we had a moment's spare time to look over your May issue, a plater acquaintance of our house informed us that our product had received a very black eye by the publishing of the letter from the foreman plater. Our plater acquaintance argued that we were getting a very poor compensation for our money in having such letters published by your paper on our material. We could not agree with him, as an article of merit should stand every investigation and controversy.

"We want to assure this foreman plater that he, by submitting this letter to your paper, has opened a way for us to thoroughly thrash this matter out to the satisfaction of all and that we have only the best of feeling towards him, under the circumstances. It is a little early at the present date to get testimonials from our friends who have purchased the material on approval with conditions to return at our expense if found unsatisfactory.

"We know who is who in the plating line and we have sold quite a little of our material in the last four months (tons of it), so our friend might reconsider his opinion of our material. If he could make up his mind to give it another trial and follow our instructions closely, and will order a 224-pound package on approval at our expense, then build up a new tank of

this material, he will see where he made his mistake in taking 50 pounds, of which his order consisted. Adding this small lot to large tanks there would be no noticeable results until enough of the material was placed in an old solution.

"We like to see these matters come up. It takes some of our limited time, but we believe it is well spent. All we ask is to be fair and do not demand impossibilities. For your paper, we must say you are following the only course to be fair to all. If we have a good thing, the plating trade cannot know it too soon. If otherwise, it should be the same way."

And so the controversy appeared to end, with sweet reasonableness reigning supreme.

On New Year's Day, 1913, the United States Post Office inaugurated its Parcels Post system, and six million parcels were sent during the first week. On January 3 Thomas A. Edison demonstrated talking movies in his laboratory at Orange, N. J. A month later the sixteenth amendment to the Constitution was ratified, and you have been paying ever since. Another month, and Woodrow Wilson was President of the United States. An era in our history ended when J. P. Morgan died on March 31 at the age of 75.

There were disastrous floods in Ohio, Indiana and Pennsylvania. They had a serious enough effect on the metalworking industries to deserve notice in the technical press as well as the daily papers: "Untold damage was done to the metal industry of Columbus and central Ohio by the unprecedented floods which swept the Buckeye State the latter part of March. The waters were higher than ever was known in Columbus, Zanesville, Newark, Dayton, Chillicothe, Kenton, Marion, Delaware, Xenia, Hamilton and many other points . . . It is believed the damages to property in general will be \$300,000,000 much of which will fall on the metal industry." (The floods were bad but not that bad: actual damage was about one-fifth that figure.)

"Under date of March 27, [the president] of the National Cash Register Company said in reply to a telegram from the *New York Times*: 'Answering your telegram of inquiry, the situation here is desperate. All of the people, except those on the outskirts, are imprisoned by water. They have had no food, no drinking water, no lights and no heat for two days. The Dayton waterworks stopped two days ago. Fire has now been raging for twenty-four hours in the center of the city and at this time is spreading. The Beckel Hotel has been burned. The weather has turned suddenly cold, with strong wind and snow.'"

The important subject of the relationship between the art of electroplating and the science of chemistry continued to receive attention. Of interest in that connection are some reminiscences of the eminent electrochemist Charles F. Burgess, who was to go on to greater triumphs and international fame: "Sixteen years ago the University of Wisconsin installed an electro-plating laboratory, and thus secured the reward of being the first university in this country to offer a course of instruction in the electro-deposition of metals. No playground can afford more entertaining recreation, no workshop can afford more absorbing employment, and no exploration trip can furnish more



obstacles and disappointments than can be found in a laboratory of this kind by one who finds pleasure in electro-chemical research. Having secured an appropriation, equipment was ordered, including eight forty-gallon finely enamelled iron tanks. These were installed in a room over a machine shop. Following book instructions, I made up a nickel bath and a copper bath, going home at night to dream of the beautiful metal deposits I should secure the next day. On arriving early in the morning, I was met at the door by the Professor of Shop Practice who conducted me to a place directly below my laboratory and exhibited a brand new \$1500 milling machine beautifully coated with copper. Investigation forced me to come to the following conclusions:

"Enamel lined tanks are to be considered with suspicion as regards their ability to hold a copper sulphate solution.

"Iron replaces copper by simple immersion, and that quite rapidly.

"A copper coating obtained from a sulphate solution does not enhance the value of a milling machine.

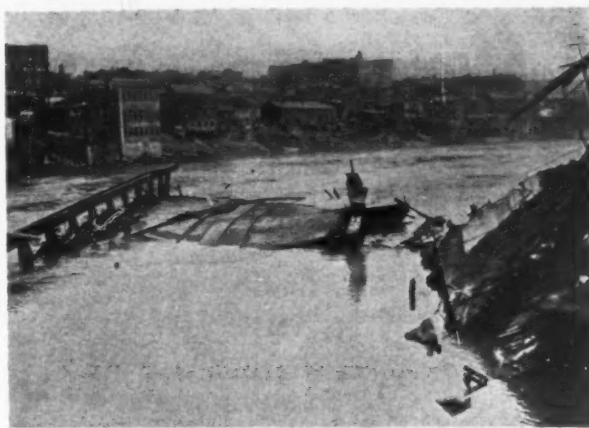
"It is desirable to have and use some knowledge of chemistry to get satisfactory results in electro-plating.

"The theme I wish to dwell upon is that in spite of this relationship there is not a sufficient intimacy between chemistry and electroplating, between the scientific and the practical man, between the college laboratories and the factory plating rooms. In looking over the membership list [of the American Electro-Chemical Society] there is one fact which is not particularly gratifying. That is, there is a very small proportion of practical electro-platers.

"Electro-plating and electro-typing have been developed mainly as an art, rather than as a science. In all industries which may be designated as arts, the rule-of-thumb method largely prevails. This is true in electro-plating, and this condition will continue to prevail. But the science of electro-chemistry and of chemistry is well worthy of study by any electro-plater who is looking for opportunity for making progress.

"I do not mean to imply that the electro-plater should reduce all of his thoughts or expressions to a scientific basis. It would be discouraging indeed, if the practical man were felt called upon to say that an excellent smooth copper deposit can be obtained at high current density for a copper sulphate bath by the addition of a mixture of 45 percent sucrose ( $C_{12}H_{22}O_{11}$ ), 10 percent dextrose and leonlose [sic] ( $C_6H_{12}O_6$ ), when, as a matter of fact, he means molasses. On the other hand, I believe that the electro-plater has perhaps given too little attention to chemical language, terms and formulas. The dependence of the electro-plater even today upon faith rather than upon chemical composition is shown in his acceptance of such materials as those which are sold under various trade names."

Which, in a way, completes the argument *re* Platers' Compounds (*vide supra*, as they say in the textbooks). An anonymous author added his bit to the discussion of plating as a science: "Plating is a science and should be treated as such. It is a combination of electricity and chemistry, the process being



Flood conditions wrecked Dayton's business street in March, 1913. This scene is near the plant of the National Cash Register Co.

as follows: an electric current acts upon a metallic salt or combination of metallic salts splitting it up into metal and *cases*, the metal or metals always going to the negative pole or cathode of the electric current and the *cases* to the positive pole or anode. It is unfortunate that manufacturers of platers' supplies and platers in general do not treat plating as a science, the same as a chemist does chemistry or an electrician does electricity, for then many of the difficulties which invariably occur in plating could be obviated. I regret to say that the manufacturer of the supplies does not pay any particular attention to plating as a science, and the crafty salesman has only one object in view, namely to sell his goods irrespective of quality or science, and the poor plater, who has to use these goods and is held responsible for the results, is placed in a very unenviable position, because he has material to use that is not the best for the purpose, and his solution and plating are apt to go wrong (as he calls it)."

The American Electrochemical Society was aware of the obligation of science to plating, and sponsored a symposium on methods and solutions for electro-plating all the commercial metals. This symposium remains today an important bibliographical source, but at least one practical plater was not impressed: "I have received from the secretary of the American Electrochemical Society several papers dealing with the electro-deposition of gold, silver, nickel, copper, brass and bronze on which discussion is invited. Considering the august body before which these papers were read and discussed, one would naturally expect to find some original investigation, or at least an epitome of modern practice in the deposition of brass and copper. Instead, what do we find? Simply a rehash of obsolete and discarded formulas garnered from the dim past, when brass plating could hardly be considered to have been on a firm commercial basis. The author very appropriately prefaces his remarks to bronze plating with the statement: 'That practically all of them are impractical.' He then proceeds to give about a dozen of these beautiful formulas. What hodgepodge to read before the American Electrochemical Society!

"Oh fie, Mr. B——. How could you have the heart to resurrect these venerable formulas and parade them

before the enlightened platers of today, after their long and peaceful interment in the quiet and sequestered fields of electroplating literature!"

Such remarks obviously called for a reply in kind from the author of the "hodgepodge," nor was it long in forthcoming: "In regard to the correspondence of Mr.——, it need only be said that the gentleman in question should at least know what he is criticizing before entering upon such a tirade as appeared in the current May number. None of the papers, as such, presented at the symposium on electro-deposition, before the Electrochemical Society, had anything to do with electro-plating. In order to get a basis upon which to work it was deemed advisable to have all the available literature gone over and all of the methods (obviously silly ones included) which have been suggested for electro-deposition recorded. From these methods the committees are to select and determine standard baths from which these metals may be deposited.

"Mr. ——'s conclusions are therefore of no value. To atone for this exhibition of hot-headedness, it is sincerely hoped that, as a loyal electro-plater and up-to-date scientist, he will come forward with some modern information on electro-plating of any metals or alloys which may be of interest or use to these committees. I will be very glad to receive from him any suggestions he may have to offer."

The above mention of committee-work is made clearer by an announcement of some importance to the electroplating fraternity which appeared in the same issue: "On June 1, 1913, the National Electroplaters' Association of United States and Canada became known as the American Electroplaters' Society. On that date the officers elected at the first national convention assumed office, and they included: *George B. Hogaboom*, New York, President. One of the results of the joint discussion of the American Electrochemical Society and the National Electroplaters' Association at Atlantic City, April 5, 1913, was the appointing of a committee to be appointed by the American Electroplaters' Society. Dr. *Wilder P. Bancroft*, Cornell University; *Charles H. Proctor* and *George B. Hogaboom*, New York, were appointed on the committee."

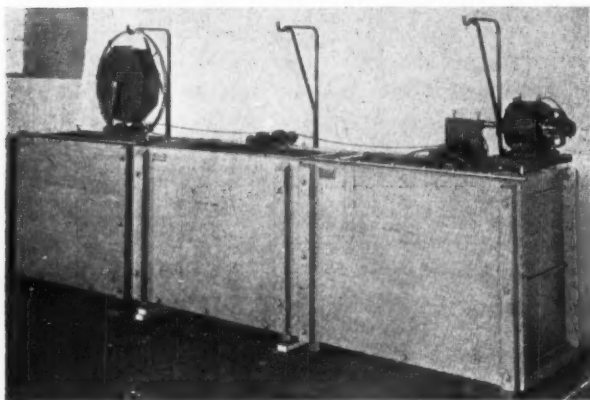
There has not been a year during which the subject

of nickel plating was neglected in the technical press. Its status in 1913 may be judged from the two excerpts which follow:

"At this time when there is so much written about new methods, and new nickel salts, one would think from the reading matter on the subject, that it was impossible to do good work with the so-called old-style solutions made and kept up with double sulphate of nickel and ammonia. Now, as the writer has done that very thing for twenty years before other things were thought of for keeping up nickel solutions, it might interest some of the readers to have a definite way of doing same described, and the reason for failure. The solution is made by dissolving 12 ounces of double nickel salts to each gallon of water, and maintained by adding the double salts from time to time as needed. Now the greatest trouble with using a double salts solution arises from overcrowding work in the tank to such an extent that your anode cannot keep up the metal content of your solution, and you soon have nothing left but sulphate of ammonia. Nothing can be done with a solution in this condition, as it will not dissolve any double salts. As the present trend of business is to overcrowd, one cannot always keep a solution of this sort self-sustaining. But a solution that is run out of metal can be put in good condition again by adding single salts.

"With a solution of this kind the writer is doing work every day that stands up under the press to form a bead after plating. Also plates nickel over nickel successfully as part of our regular work, and as to time, I have plated a tank full of work in two minutes, and it stood nickel buffing, too! To say, however, that I am doing work in that time is not so, as it is as inconvenient as to leave it in two (2) hours, for you can not handle the work fast enough. This is only what can be done if need be, and what is more, the work comes out as bright as if nickel buffed."

The second quotation is from an article on a practical nickel solution for die castings: "One of the important developments in recent years in the production of metal goods is what is known as die castings. Owing to the high percentage of zinc used, considerable difficulty has been experienced by many platers in producing a successful nickel deposit on these castings. In nickel plating zinc castings in the ordinary nickel bath, unless the castings become at once coated with a uniform deposit, black streaks appear on the surface. If the articles contain depressions, a high amperage must necessarily be used and such a high current frequently causes burning of the deposit, which causes considerable trouble in the final polishing. Peeling of the deposit also frequently takes place. To overcome the difficulty noted, the zinc castings very often are previously coated with copper in an alkaline copper bath. This apparently overcomes the difficulty resulting from black streaks but it often develops another trouble, which proves more serious than the first. This latter difficulty generally does not develop for one or two days after the castings have been plated and finished and then hundreds of minute blisters will appear upon the finished surface, and if



Multiple unit barrel plating machine exhibited in 1913 by the Bennett-O'Connell Co. at the Chicago Exhibition of the Foundry and Machine Exhibition Co.

these are broken, it will be found that the deposit is completely lifted from the surface.

"This proves to be a puzzling phenomenon to the plater who thinks of everything excepting the correct cause of the trouble. The cleaning operations are gone over, the bath is frequently doctored, the castings are boiled out for long and short periods, the current is increased and decreased, and still these dreaded blisters appear. Occasionally the plater realizes the cause of the trouble. It is well known that when copper and zinc are immersed in a dilute acid solution an electrical action is developed, producing a positive and negative current. The positive develops oxygen; the negative, hydrogen. This is exactly what occurs when copper-coated zinc articles are plated in a nickel bath, which is slightly acid. By local action hydrogen is developed at the surface of the zinc and being coated with the film of copper, becomes occluded or shut up.

"The writer has made numerous experiments in an endeavor to produce a simple solution that would overcome the difficulties noted, so that the deposit could be applied directly to the zinc castings. The formula which proved eminently satisfactory consists of the following:

Nickel ammonium sulphate	8 ozs.
Sulphate of magnesium	2 ozs.
Water	1 gal.

"The solution is used cold and deposits readily at two volts pressure. I believe the addition of sulphate of magnesium to nickel baths of various compositions will prove more satisfactory as a conducting salt than the ammonium or chloride combinations."

In April of 1913, the State Legislature of California passed a law prohibiting aliens from owning land in the state. This was specifically pointed at the Japanese, who of course were doomed to remain aliens. President Wilson protested to Governor Johnson, and in May Japan lodged a formal protest. In the meantime Arizona had also passed such a bill. The new-born Republic of China was officially recognized. The summit of Mt. McKinley in Alaska was reached. The seventeenth amendment (direct election of Senators) was ratified, with Connecticut becoming the 36th state to endorse it. The Supreme Court had handed down one of its more important decisions in the so-called Minnesota Rate case, and the wave of labor disputes which disturbed the country brought to the surface a relatively new issue: the right to organize.

In our plater's journals an old issue flared anew, broached in an article on silver plating: "The position to be taken is that the voltmeter is more necessary than the ammeter in the plating room if only one instrument is available. The rate of deposition of metal from a plating solution is directly proportional to the amperage to each square inch of cathode surface. The amperage is always directly proportional to the voltage and inversely proportional to the resistance. If, therefore, the voltage is increased the amperage will increase at the same time and vice versa, that is if the resistance under both conditions is the same. If the ammeter is used alone it would be necessary to carefully estimate the square inch surface of the

cathode and calculate the number of amperes that would be necessary. This calculation is not always possible; for instance, if the square inch surface of 50 pounds of wood screws was wanted so that the ampere reading could be had and a definite amount of metal could be deposited. To do this would require the services of a corps of expert lightning calculators so that there would be no delay in changing the work in the bath. These calculators are at present unknown in the plating room and therefore the plater must be satisfied with guessing the amount of cathode surface and consequently the correct amperage to be employed." [Modern platers now have charts available for such calculations. Ed.]

As before, this defense of the voltmeter evoked rebuttal: "I have worked with an ammeter for about 25 years and have also used a volt meter for 15 years, but very seldom use it, as the ammeter generally tells me what I wish to know. I would like to ask how the authors arrived at the conclusion that one volt was the right pressure to use. I guess I arrived at the amperage to use the same way, and, as the tank is generally run full, the same number of amperes will do the same work, but when the tank is not full, then the ammeter is on the job. I have done silver plating by weight for years with an ammeter alone and as you generally have the same work I had a chart of amperes to use on all work, and if it did not plate right at that current I knew something was wrong, the same as you do when the work does not come out right at one volt. Now I wish to state right here that I wish the gentlemen to come back at me if I am wrong, as I am not too old to learn and to say the least I am some times wavering in my position, thinking it is a matter of how you get started."

The olive branch tentatively offered in the last sentence was spurned: One cannot help but admire J—— for his stick-to-it-iveness, which must eventually solve the problem for him. Every once in a while some one apparently puts him down for the count, but always just before the stroke of ten is counted he comes up smiling, still seeking to land one in the neighborhood of his opponent's solar plexis [sic]. While these controversies sometimes assume awkward proportions principally on account of a too lavish use of sarcasm yet I presume some good comes of them, especially so if the combatants never come face to face.

"Personally I am against Mr. J—— in this Volt-Ammeter argument, but that 'mox nix ous' [sic] or something like that." This letter then continues to argue against some of the algebraic calculations which we have not quoted. Mr. J—— replied:

"I must apologize for the blunder I made. I was very badly mixed up and thank 'Voltammeter' very much for that part, although it does not change my contention that one volt is obtainable in different ways and with quite a difference in the current flowing, and consequently the metal deposited in a given time, which is quite a serious matter with silver. Now please avoid the sarcasm and give some everyday practical reasons why you differ with me and I will answer in the same good spirit, as I am after information and





An early photograph of Dr. Oliver P. Watts, one of the pioneers in nickel plating. Most modern bright plating nickel baths are still based on a formula developed by Dr. Watts.

not fight, and my 'sticktoitiveness' will get it for me." We hope it did.

We have space only to quote without comment some of the helpful hints for platers, and odd bits of information, which were found handy for rounding out the pages of our technical journals.

"Things every plater should know: That a silver solution should be kept free from sediment or it will settle on the work and cause pits. . . . That boracic acid is an excellent ingredient of nickel plating solutions as it produces a white deposit and prevents pitting. . . . That sal-ammoniac in a nickel solution increases the conductivity and causes the anodes to dissolve more freely. . . . That the amount of any metal deposited is dependent upon the number of amperes passing through the solution. . . . Chromium can be deposited electrolytically but as far as known no use has been made of the deposit. . . . Many of the new nickel plating salts now being sold upon the market contain magnesium sulphate."

"One of the common difficulties encountered in nickel plating steel goods is that they rust when exposed to the atmosphere. In this day of 'rust-proof' coatings, more is expected of a nickel deposit than formerly, and, therefore, when rusting takes place, as it frequently does on nickel plated steel goods within a short time after plating, a customer usually begins to complain. Much of the rusting of nickel plated steel goods is the fault of the plater and the cause is quite simple: the nickel is buffed off."

"It is not practicable to filter a nickel plating solution, nor is it advisable. It should be allowed to settle and the bottom not stirred up."

"The problem of waste ends of anodes is an important one and it does not seem to be any nearer solution than many years ago. It forms quite a loss in the plating trade."

As is our custom, well-established by this time, we close this review of 1913 with a glance at the question-and answer columns. In truth, the type of questions

asked, and the answers vouchsafed should paint the most vivid picture possible of the state of the art in that bygone era.

Q: We have been instructed to use sugar of milk in a bronze solution. Please advise if this is correct.

A: We think your informant is trying to play a joke upon you or you have made a mistake in the information he gave you. Acetate of lead is commonly called sugar of lead and this is the material he probably refers to. This material is frequently used as a brightener when dissolved in caustic soda in copper and bronze baths.

Q: What will be the effect of a nickel plating solution standing in a galvanized iron can? We have left our nickel solution in it and find that it does not give as good a deposit as before. A: A nickel solution will attack the zinc on the galvanized can, and dissolve it. The solution will then contain zinc which produces a dark nickel deposit. You should keep your solutions out of galvanized iron vessels.

With that note of reassurance we may take leave of our colleagues of thirty-six years ago and their trade journals. Although nickel anodes survived a fire unscathed, other news was not so heartening. The pot was beginning to boil in Europe, and at home the faith of our New England fathers received a mortal blow, for on December 10, 1913, for the first time in forty years, the New York, New Haven and Hartford Railroad passed its dividend!

## WHERE DO WE GO FROM HERE?

(Concluded from page 51)

### Detection of Contaminants

As time goes on, more and more researches indicate that small quantities of impurities in the plating bath may have highly undesirable effects on the plate. At the present time a plater who unknowingly contaminates a tank is not aware of his trouble until a number of poorly plated specimens come out of the tank. Thus there is considerable loss of time and money before the contamination effect becomes known, recognized and corrected. An electronic device that would recognize harmful contamination when it occurs and sound or flash a signal to warn the plater not to place any more work in the tank, would be a great boon. Such a system could be devised to also throw more purification units into the set up and/or to increase their action as shown in Figure VII and then disconnect same as soon as the concentration of the contaminant has been reduced below the harmful level, and signal the operator that the bath is ready to produce again.

Here then are some of the things that electronics can do to simplify things for the plating industry and make the plater's life one bed of roses. Calling all inventors!

### References

1. *Journal Electrodepositor's Tech. Soc.* 1949, 24, 79-90.
2. *A.E.S. Proceedings*, 1948, p. 203-211.

# Shop Problems

Abrasive Methods—Surface Treatments—Control  
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

## Making Up Copper Cyanide Bath

**Question:** We have had some difficulty with the materials dissolving when making up a new copper cyanide plating bath, and obtained quite an appreciable amount of sludge. We believe that our procedure must be at fault, and would appreciate your telling us the proper procedure to use.

J. E. W.

**Answer:** In making up copper cyanide baths, the tank is first filled about  $\frac{3}{4}$  full of water, which is then heated to about 100°F. The sodium cyanide is then placed in a basket and suspended in the bath, shaking occasionally until the cyanide is all dissolved. The copper cyanide is then stirred into the bath a little at a time, with constant stirring, until the entire amount has been dissolved. After that the other constituents are added in small quantities, with stirring, until the complete list of ingredients have been brought into solution. It would then be preferable to filter the solution before use to eliminate any solid particles that might cause rough plating.

## Stripping Gold

**Question:** How can we strip off defective deposits of gold from a bright nickel plated part without requiring any further buffing for replating?

T. F. F.

**Answer:** If the parts are made anodic in a cyanide bath (about 12 oz./gal. of sodium cyanide) the gold can be stripped off without destroying the luster of the nickel or causing it to become passive. Replating can then follow immediately.

## Stripping Terne Plate

**Question:** Please advise us if it would be necessary to strip off the terne plate from some sheet metal boxes before cadmium plating them. If they should be stripped, how can we do it?

S. S. R.

**Answer:** We would advise stripping off the terne (Lead-tin alloy) plate before attempting to cadmium plate the parts. This stripping can be done by making the parts anodic in an 8 oz./gal. solution of sodium hydroxide at 2-4 volts. Rochelle salts added to the bath will speed up the stripping action. Another strip is glacial acetic acid to which 5% of hydrogen peroxide has been added.

## Excessive Current in Chrome Plating

**Question:** We are chrome plating cylinders that are 4" in diameter and 20" long. The work comes out of the tank with a pitted condition. The solution contains 40 oz./gal. of Chromic acid and .5 oz./gal. of sulfuric acid. We use a current of 3000 amps. when plating two cylinders at a time. We have been having this trouble for some time on the cylinders, although other smaller work seems to plate all right. Do you know what may be causing our trouble?

D. C.

**Answer:** Our calculations indicate that you are using a current density of about 6 amperes per square inch, which is about three times the current normally used in chrome plating. We suggest that you reduce this to 2 amps./sq. inch, or a total of 1000

amperes for the tank load of two cylinders. If this does not clear up your trouble it is possible that your cleaning cycle before plating may be at fault.

## Brightener for Silver Plating

**Question:** In your Shop Problem section in the June issue, you requested information on a silver plating brightener called "Grunau 1005." We recently had occasion to investigate this matter, and a careful search of the Patent files in Washington and the files of Alien Property Custodian revealed nothing under this name. We would also be pleased to learn more about this material if you have managed to find out any more about it.

D. I. S.

**Answer:** That such a material as "Grunau 1005" exists there can be no doubt, as it was referred to in a recent paper presented before the Electrodepositors Technical Society (England). However, we have made numerous inquiries and have also discovered nothing further. We repeat our plea to any of our readers who may know something about this material to communicate with us. All that we have been told is that it was developed by a German inventor named Weiner, and that it is being used in several plants in Germany.

## Throwing Power of Zinc Solutions

**Question:** We are plating sheet metal boxes 9" x 4" x 3 $\frac{1}{2}$ " deep, and find that the inside corners do not plate well. We use a cyanide zinc bath of the usual type, and would appreciate any suggestion that you might have as to how we could satisfactorily cover these recessed areas.

A. A. R.

**Answer:** Assuming that you are racking the parts properly so no air is entrapped in the corners, you might try using a lower bath temperature and increasing the total cyanide content of the bath by adding sodium cyanide. Both of these conditions promote better throwing power in cyanide zinc

solutions. Increasing the distance between the anodes and the parts being plated may also help, as this will tend to distribute the zinc plate more evenly on such recessed articles.

### Pitting in Nickel Plating

**Question:** We are having difficulty in our nickel plating process in that the underside of the parts comes out of the tank with a rough, pitted surface. This condition is not visible on the metal before plating, which makes us discount the base metal as a factor. We wonder if you can tell us what is happening?

S. H. W.

**Answer:** Examination of the sample submitted shows a common pitting problem. Not knowing what kind of a nickel bath you are using, we cannot make specific recommendations. If it is a proprietary bath, the technical department of your supplier should be contacted. If an ordinary dull nickel bath, the addition of about 1 cc. of hydrogen peroxide for each gallon of solution should help. Addition of a small amount of suitable wetting agent, plus use of moving cathode rods will also help overcome this problem.

### Bright Dipping Gold-Filled Stock

**Question:** In dipping gold filled stock having a gold alloy layer on one side with the pure nickel or copper-base alloy on the other side, we find that after short usage we begin to get a black smudge on the gold alloy side. We are using the usual dips containing nitric, sulfuric and hydrochloric acids. Can you tell us how to avoid this trouble?

D. F.

**Answer:** The black smudge on the gold alloy is an immersion deposit of copper, nickel, etc. from the base metal which dissolves readily in the bright dip acids. It will increase as the acid concentration decreases with use, and the proper way to control this action is to maintain the dipping bath at a high concentration of acid, preferably high in nitric acid, as immersion films of copper and nickel are not so readily formed from strong nitric acid baths.

### Etching Steel

**Question:** We have a problem in preparing the surface of cold-rolled steel for the application of rubber by vulcanizing. Specifications call for

a lightly etched surface similar to a fine sandblast finish. Can you give us a formula for doing this etching in an acid solution?

F. T. M.

**Answer:** The following baths can be used to produce a light uniform etch on steel:

- 1) Sulfuric acid . . . . . 10% by Vol.  
Ferric sulfate . . . . . 1/4-1 3/4 lbs./gal.

The amount of ferric sulfate is determined by the rate and depth of etching required, the larger amounts of ferric sulfate producing a faster and deeper etch.

- 2) Nitric acid . . . . . 12 oz.  
Acetic acid . . . . . 2 "  
Denatured alcohol . . . . . 3 "  
Water . . . . . 12 "  
LePage's liquid Glue . . . . . 1/2 "
- 3) Nitric acid . . . . . 12 oz.  
Denatured alcohol . . . . . 2 "  
Water . . . . . 34 "

This bath will etch more rapidly than will bath #2.

An important factor in producing

a uniform light etch is absolute chemical cleanliness of the steel surfaces, for which the usual pre-plating cleaning cycles can be used.

### Silver Anode Corrosion

**Question:** We are sending a small piece of one of our silver anodes for your examination. This anode shows many white spots, whereas other anodes that we have used showed a uniform white matte surface. Does this indicate that anything may be wrong with our plating conditions?

W. E. J.

**Answer:** The variation in light and dark areas on the sample anode is simply the development of the crystalline pattern of the metal, and is more noticeable in this anode than others because of the large crystalline size. In a very fine-grained anode this difference in etching pattern is usually not noticeable. This large crystalline size should not affect its use as a plating anode, assuming that is of otherwise high purity.

## PROFESSIONAL DIRECTORY

### HENRY LEVINE & SON, Inc.

**Metal Finishing Consultants**

Analysis—Plant design—  
Process development

67-54 Burns Street, Forest Hills, N. Y.  
Boulevard 8-8897

### G. B. HOGABOOM JR. & CO.

**Consulting Chemical Engineers**

Metal Finishing — Electrodeposition — Solution  
analyses. AIR FORCE CERTIFICATION TESTS—  
Salt spray, thickness of deposits, adhesion.

44 East Kinney St. Newark 2, N. J.  
MArket 3-0055

### "ELECTROCHEMICAL TECHNOLOGY"

E. J. HINTERLEITNER AND  
ASSOCIATED ENGINEERS

669 Summit Ave., Westfield, New Jersey  
Phone: Westfield 2-4766

Comprehensive Consulting Service for  
ALL Metal-Finishing Problems  
Complete Systems and Installations prepared  
for ALL MODERN PROCESSES

FOR: Aluminum and Magnesium Treatments  
Plating on Aluminum

FOR: ELECTROPOLISHING (Co-Originator of  
First American processes)

FOR: Newest "Filling" Highspeed Nickel

FOR: ALL HIGH SPEED BRIGHT, SEMI-BRIGHT  
Plating Processes (acid, alkaline)

FOR: Highspeed SILVER and GOLD Plating  
INDIUM PLATING, etc.

CONTINUED: NEXT MONTH

### SCIENTIFIC CONTROL LABORATORIES

Finishing Consultants—Registered Engineers  
Salt Spray—Thickness Testing—Analyses  
PLANNING—RESEARCH—DEVELOPMENT  
HAYmarket 1-2260

600 BLUE ISLAND AVENUE CHICAGO 7, ILL.

### JOSEPH B. KUSHNER, Ch.E.

**Metal Finishing Consultant**

Problems in Automatic Plating, Electro-  
forming and Plastic Plating; Plating  
Plants Installed.

233 W. 26th St., New York 1, N. Y.

### JOHN W. MAGLY

**Consulting Chemical Engineer**

ELECTROPLATING PROCESSES

DEVELOPMENT—ANALYSES

TROUBLESHOOTING PLANT PROCESSES

2731 Vine St. Cincinnati 19, Ohio

Avon 3977

## PLATERS TECHNICAL SERVICE, INC.

**ELECTROPLATING AND  
CHEMICAL ENGINEERS**

A complete service for metal finishers  
including solution and deposit analyses,  
process development and plant design.

New York Laboratory

59 East 4th St. New York 3

ORchard 4-1778

Chicago Laboratory

509 S. Wabash Ave. Chicago 5

Harrison 7648

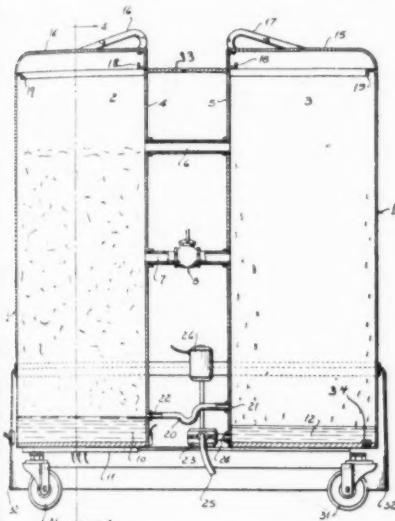


# PATENTS

## Degreasing Machine

U. S. Patent 2,469,040. Mose Jaffa, assignor to Optimus Equip. Co.

A degreasing device for use with a vaporizable liquid, said device comprising a tank, a pair of spaced partitions in said tank dividing it into two spaced compartments and an intermediate compartment, said spaced



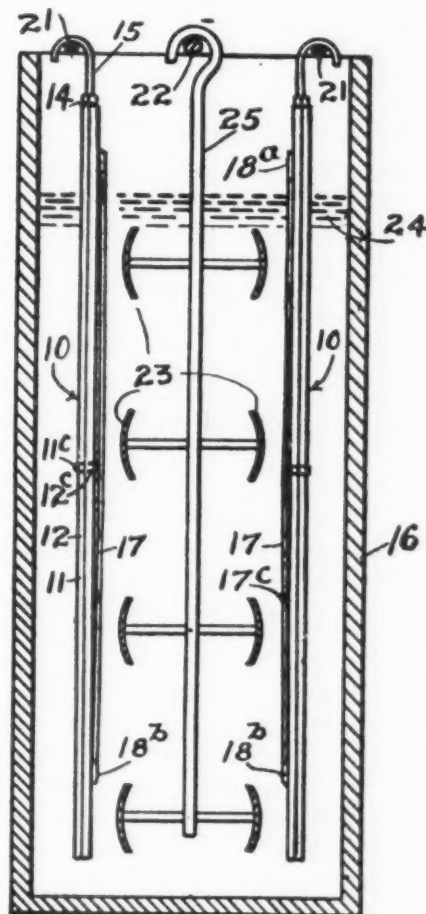
compartments being closed at the sides and bottom and open at the top, a zinc lining in each of the two spaced compartments to protect them against the corrosive action of the grease solvent, an electric heating element under the first of said two spaced compartments for heating the solvent, a removable cover at the top of said first compartment, a conduit providing communication between the two spaced compartments adjacent their top ends, a second conduit disposed below the first conduit and also providing communication between the two spaced compartments to further facilitate the flow of vapor, both of said conduits being disposed across the intermediate compartment, the lower of said conduits having a valve mounted therein which is disposed in said intermediate compartment and which is adapted to control the flow of vapor through said lower conduit, a third conduit mounted in said intermediate compartment, below the first two conduits, said lower-most conduit serving as a return duct for the vapor which passes through the first two conduits into the second of said spaced compartments and therein condenses, said

intermediate compartment being also provided with a motor-driven pump which communicates with the bottom of the second of said spaced compartments, its outlet being connected to a flexible spraying hose, whereby the condensed solvent in the second of said spaced compartments may be sprayed upon objects which require degreasing.

## Anode

U. S. Patent 2,467,852. Walter L. Pinner, assignor to Houdaille-Hershey Corp.

A composite metal anode for use in the electrodeposition of the metal of which said anode is formed, which comprises a plurality of sheets of electrolytic metal, pairs of said sheets be-



ing joined together lengthwise through the metal of the respective sheets to form elongated panels and the panels being connected along their upper edges, a suspending member secured to said connected upper edges, and means temporarily protecting the joined together portions of said panels from electrolytic attack during the early stages of the use of said anode in electrodeposition work.

## Conversion Coating on Zinc

U. S. Patent 2,469,015. J. E. Stareck and L. M. Corliss, assignors to United Chromium.

A composition of matter for make-up of aqueous electrolytic baths for the production of surface conversion coatings on metals of the group consisting of zinc, tin, lead, copper and silver, having as its essential constituents a water soluble alkali-metal chromate and a water soluble compound containing auxiliary acid radicals of the group consisting of  $\text{SO}_4$ , F,  $\text{SeO}_4$  and  $\text{SiF}_6$  in the respective weight proportions.

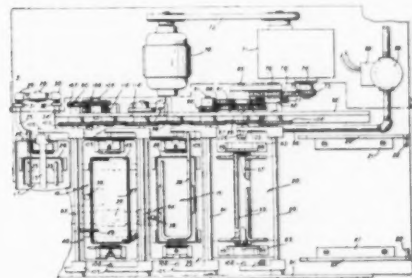
$\text{Cr}^{VI}/\text{SO}_4=10:1$  to  $30:1$

$\text{Cr}^{VI}/\text{SeO}_4=10:1$  to  $30:1$ ,  $\text{Cr}^{VI}/\text{F}=50:1$  to  $150:1$  and  $\text{Cr}^{VI}/\text{SiF}_6=20:1$  to  $60:1$ , the amount of alkali metal in said composition being sufficient to impart a pH of 2 to 7 when dissolved in water.

## Plating Machine

U. S. Patent 2,469,470. Nelson H. Mageoch, assignor to Western Electric Co.

A machine for successively electroplating groups of articles variable in number, the machine comprising an electroplating bath, like holders each formed to receive and hold a variable number of the articles from one to a given maximum number of the articles, a loading position to successively receive the holders with their articles to be plated, an electroplating bath disposed at a position spaced from the loading position, transfer elements actuable to transfer the holders from the loading position to the bath, where the articles will be positioned in the bath, and from the bath to another position spaced therefrom,



mechanism operable to actuate the transfer elements to transfer the holders at given intervals of time whereby the articles held thereby will be positioned in the bath a known length of time plating circuit for directing a plating current through the articles and the bath, resistance units includ-

ing electrical resistances of known values and corresponding in number to the said maximum number of articles capable of being held by each of the said holders, means operable in synchronism with the mechanism to alternately include the resistance units in the plating circuit for the articles, of alternate holders, moved into the bath, and separate means for each resistance unit actuatable, prior to its unit being included in the plating circuit, to preset its unit to include, of its resistances, a number equal to the number of articles to be positioned in the bath by its holder when the preset unit is included in the plating circuit.

### Sealing Anodized Coatings

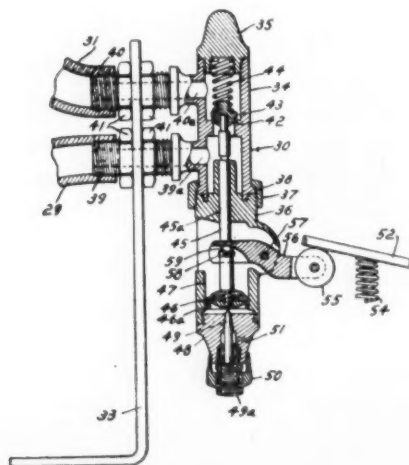
*U. S. Patent 2,469,237. J. F. Mason and A. H. Beebe, Jr., assignors to Reynolds Metals Co.*

In sealing anodized aluminum surfaces, the improvement which comprises anodically treating the anodized aluminum surface in an aqueous solution of sodium phosphate having a pH of about 4.1-5.0 at a temperature of about 65°-85°C. with a current density of about 1-2 amperes per square foot of anodized surface until sealed.

### Spray Gun for Liquid Abrasives

*U. S. Patent 2,471,727. James P. Creamer, assignor to Lea Mfg. Co.*

In an apparatus for applying a liquid buffing compound to a buffing wheel, a spray gun, means for supplying buffing liquid and compressed air to said gun, and a timer mechanism for automatically cutting off the supply of air at the end of a predetermined time interval, said timer mechanism including a normally closed valve for con-



trolling the flow of said liquid and air, a longitudinally movable valve rod connected at one end to said valve, a lever connected to an intermediate portion of said rod and adapted to move the rod to open the valve, a spring urging said valve to closed position, and a dash pot at the other end of said rod to hold the valve open against the force of said spring for a predetermined time period.

### Tin Coating Inside of Copper Tubes

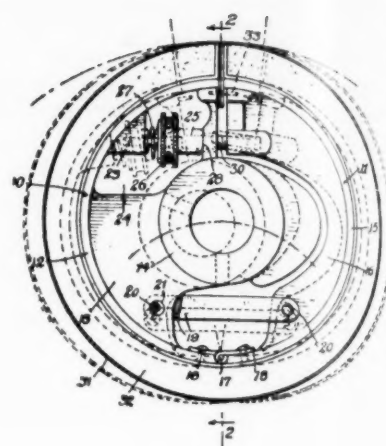
*U. S. Patent 2,470,689. D. K. Crampton and M. L. Wood, assignors to Chase Brass & Copper Co.*

The process of coating the interior of a substantially straight copper-base metal tube, with tin-base metal, comprising: heating a substantially straight copper-base metal tube to a substantially-uniform temperature substantially throughout its length between its opposite end portions, which temperature is at least as high as the melting-point of the tin-base metal with which the interior of the tube is to be coated but not in excess of about 600°F., by means of the inherent resistance of the tube to the passage of electric current longitudinally through the tube, by applying electric current to the said opposite end portions of said tube and passing said electric current longitudinally through said tube; rotating the said heated tube about its longitudinal axis with said axis in a position inclined to the horizontal with one end of said tube higher than the other end with both of said ends open; and then introducing said tin-base metal in molten condition into the said open higher end of said rotating inclined heated tube into molten alloying coating contact with the interior surface of said tube, any excess of said molten tin-base metal draining out through said open lower end.

### Abrasive Wheel

*U. S. Patent 2,471,934. Joseph Chudner.*

A wheel composed of a pair of mating sections hingedly connected at their peripheral portions, a fixed arbor and an abutment on one of said sections, a threaded pin fixed on the other one of said sections, and a rotatable and axially movable nut surrounding one end of the arbor for threaded engagement with the pin and also disen-



gagement therefrom for the purpose of causing the closing pivotal movement of the sections toward each other into and securing them in a wheel forming relation by threaded engagement of the nut with the pin while engaged with said abutment or causing the opening pivotal movement of the sections away from each other into a split relation by unthreading and disengagement of the nut from the pin while engaged with said abutment.

### Nickel Plating Bath

*U. S. Patent 2,469,727. Raymond A. Hoffman, assignor to E. I. DuPont de Nemours.*

A nickel plating composition comprising a nickel compound selected from the group consisting of nickel sulfate, nickel chloride, and mixtures of nickel chloride and nickel sulfate, and 1/200 to 1/50 parts by weight of a sultone.

### Nickel Plating

*U. S. Patent 2,467,580. Henry Brown, assignor to Udylyte Corp.*

The method of electrodepositing nickel which comprises electrolyzing an aqueous acid solution comprising essentially a material selected from the group consisting of nickel chloride, nickel sulfate, a mixture of nickel chloride and nickel sulfate, a mixture of nickel sulfamate and nickel chloride, and a mixture of nickel chloride, nickel sulfate and nickel sulfamate, and said solution having dissolved therein an organic compound selected from the group consisting of sulfonic acid derivatives of phenyl sulfones and sulfonic acid derivatives of naphthyl sulfones, said solution having a pH falling within a range of from 1.5 to 6.

## DECORATIVE NICKEL AND CHROMIUM PLATING ON STEEL

### A Comparison of Plating Thickness Specifications of Various Services, Societies, and Industrial Firms

#### AMERICAN SOCIETY FOR TESTING MATERIALS

##### Specification A166-45T

Minimum thickness on significant surfaces—

	Copper + Nickel	Final Nickel	Chromium
Type D.S.	.0020"	.001"	.00001"
Type F.S.	.00125	.0006	.00001
Type K.S.	.00075	.0004	.00001
Type Q.S.	.0004	.0002	.00001

#### Notes—

For Type D.S. coatings, if copper is used in excess of .0001" its minimum thickness shall be .00075".  
Salt spray resistance shall be, respectively, 96, 72, 48, and 16 hours minimum.  
Spot test used for checking chrome thickness; microscopic or magnetic test used for copper-nickel thickness.

#### NAVY DEPARTMENT

##### Specification 46-P-4 Type 1

Minimum thickness on significant surfaces—

	Indoor Service	Outdoor Service
Nickel + Copper	.00075"	.002"
Final Nickel	.0004	.001
Chromium	.00002	.00002

#### Notes—

In outdoor service coatings, if copper is used in thicknesses over .0001" the minimum thickness shall be .00075".  
Significant surfaces are those touched by a  $\frac{3}{4}$ " diameter ball.  
Spot test used to check chrome thickness. Other plating checked by microscopic method.

#### GENERAL MOTORS CORPORATION

##### Specification 4251-M

Minimum thickness on significant surfaces—

	Copper + Nickel	Final Nickel	Chromium
Code 300	.003"	.0007"	.00001"
200	.002	.0006	.00001
150	.0015	.0005	.00001
100	.001	.0004	.00001
75	.00075	.0002	.00001
50	.0005	.0002	.00001

#### Notes—

.0008" of copper, buffed to cover surface defects, followed by .0007" of bright copper may be used for Code 300 and 200 coatings. This sequence subject to modification, provided salt spray requirements are met.  
Preliminary copper deposit optional on Code 150, 100, 75 and 50.

Salt spray resistance requirements.

Code 300—144 hrs. (Complete resistance) 216 hrs. (minor pinholes).  
Code 200—96 hrs. (Complete resistance) 144 hrs. (minor pinholes).

150—48 hrs. (Minor pinholes)

100—32 hrs. " "

75—24 hrs. " "

50—16 hrs. " "

#### SOCIETY OF AUTOMOTIVE ENGINEERS

This organization has no official regular specifications for nickel-chrome plating. It recommends that the specifications set up by the American Society for Testing Materials be used insofar as possible. No Aeronautical Material specifications (AMS) have been adopted by the SAE for nickel-chrome plating.

#### ARMY-NAVY AERONAUTICAL SPECIFICATIONS

##### Specifications AN-P-34 and AN-P-39

Minimum thickness on significant surfaces—

Type 1 (Decorative)	Final Nickel	.001"
	Chromium	.00002"

#### Notes—

No requirements for preliminary copper deposits, either as a "strike" or in heavier deposits. Presumably copper may be used as a preliminary coating, provided final nickel thickness conforms to above.  
Salt spray resistance—48 hours minimum.  
Microscopic method for checking thickness is standard. Magnetic and spot tests may be used.  
Significant surfaces are those touched by a  $\frac{3}{4}$ " dia. ball.

#### FORD MOTOR COMPANY

##### Specification P-40

Minimum thickness on significant surfaces—

	Copper	Nickel	Copper + Nickel	Chro- mium
Class A	.00025"	.00055"	.0009"	.00001"
A (Alter.)	.00005	.0008	.00085	.00001
B	.0002	.0003	.0006	.00001
B (Alter.)	.00005	.0005	.00055	.00001
C	.00005	.0003	.00035	.00001

#### Notes—

Salt spray resistance—Class A 50 hrs.  
Class B 25 hrs.  
Class C 12 hrs.

Microscopic method used for checking thickness of copper and nickel. Spot test used for checking chrome. Magnetic methods are alternates.



# Recent Developments

New Methods, Materials and Equipment  
for the Metal Finishing Industries

## New Anode Packaging Method

*The Harshaw Chemical Company,  
Dept. MF, Cleveland 6, Ohio.*

This firm has solved the problem of shipping anodes with a cheap and simple palletizing arrangement which can be thrown away after use.

In making up the package the anodes are placed in a holding jig and corrugated board placed above, below and



between the anodes. The steel strap is then threaded through the two holes in the skid and up over the anodes as shown in the lower part of the illustration. Drawing up the strap tight brings the skid up to the anodes. The anode package, save for the skids, is then wrapped with burlap as shown sealed, labelled and is ready for shipment. This design gives all the advantages of a pallet shipment with none of the disadvantages, it is claimed. It is essentially a built-in pallet.

Although the finished package weighs 500 or 1,000 pounds, as the customer selects, yet it is easily handled with a fork, lift, or hand truck due to the built-in skids. Since the package is inexpensive it is not necessary to return it, which saves freight, not to say deposits commonly charged for pallets.

## Durimet 20 Sheet and Plate

*The Duriron Co., Inc., Dept. MF,  
Dayton 1, Ohio.*

Official announcement of the production and availability of Durimet 20 sheet and plate is being made for the first time, by the above firm.

The Durimet 20 analysis was developed during the war for severe corrosive applications that the standard 18-8 stainless steels did not withstand. The most notable and widespread application is for handling sulfuric acid. In 1947 the company undertook to roll this analysis, and early in 1948 announced the availability of bar, strip and tubing. Now they announce the successful production of sheet and plate.

The importance of this announcement lies in the fact that Durimet 20 can be satisfactorily applied to corrosive services formerly uneconomically handled by non-metallics of insufficient strength or heat transfer, or by extremely high priced metals, or by low price metals with short life. While higher in price than ordinary stainless steels it may in some services outlast it by 100 to 1 or simply indefinitely, it is claimed.

Production for stock has commenced, this being confined chiefly to gauges 24 to 11 and to the smaller thicknesses of plate. The range is from 24 gauge to  $\frac{3}{4}$ " plate.

Complete information on this material can be had by writing to the above address.

## Experimental Cleaning Service

*Magnus Chemical Co., Inc., Dept.  
MF, Garwood, N. J.*

The above firm, manufacturers of automotive and industrial cleaning chemicals and equipment, announces the inauguration of a free production test cleaning service. Companies wishing to test a new cleaning method or material can eliminate the time, expense and bother of conducting cleaning tests on their own premises by tak-

ing advantage of this new service. At Magnus, where a wide variety of cleaning equipment and chemicals are available in a special building provided for the purpose, full scale production cleaning tests can be conducted under actual working conditions.

The building is equipped with four mechanically agitated cleaning machines featuring three different types of agitation. These are in addition to a turntable type spraying and rinsing machine. Two different types of cleaning tanks have also been installed, along with a drying oven, deburring and



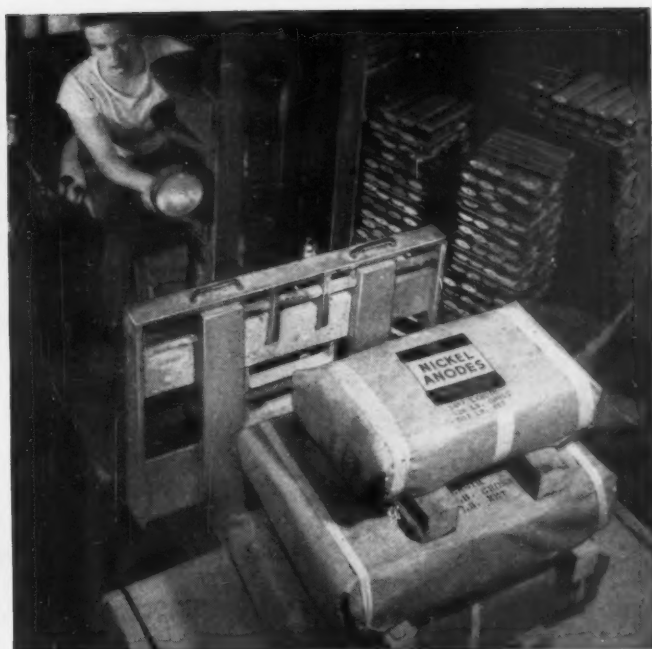
burnishing barrels, a steam gun and solvent cleaner sprayer. Both heated and unheated machines and tanks are available.

With the above equipment it is now possible to determine not only the best chemicals, equipment and method for achieving a desired cleaning result, but actual cleaning times and costs can be accurately recorded as well. Thus the best and most economical cleaning procedure can be determined in any particular case.

## Spotless Parts Dryer

*Randall Mfg. Co., Dept. MF, 801  
Edgewater Road, New York 59, N. Y.*

Recently announced by this firm is their new Ramco Spotless dryer, which uses a combination of cold and hot air blast to dry all moisture from finished parts. With this equipment the production of spotless finished parts is possible, according to the firm, and the usual sawdust drying methods, which are costly and cumbersome can



**HARSHAW**

# Packaged Anodes

**easy to handle**

**easy to open**

**no deposit**

**no return**

**no extra cost**

**keeps anodes clean**

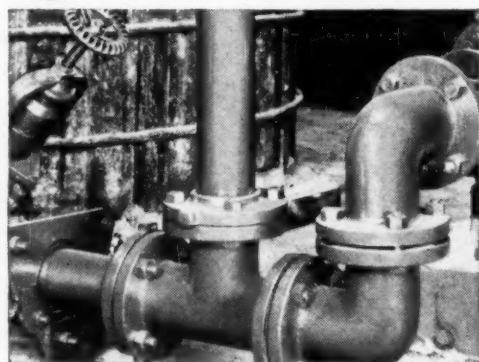
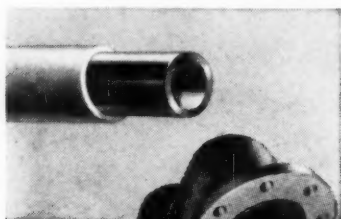
Harshaw anodes are now delivered in compact packages at no extra cost to the customer. The new Harshaw anode packages, which feature built-in skids, facilitate quick handling by mechanical or hand trucks. These anode packages stack easily and quickly. No container deposits or returns are necessary. Order your anodes from Harshaw. You will get a dependable product wrapped in a compact, protective package.

**THE HARSHAW CHEMICAL CO.**

1945 East 97th Street, Cleveland 6, Ohio  
BRANCHES IN PRINCIPAL CITIES



# saran lined steel pipe



## resists corrosion

- reduces shut-downs and lost production!
- saves time and labor!
- readily field-fabricated!

The conveyance of corrosive liquids can prove as hard on profits as it is on equipment. Saran Lined Steel Pipe is designed and constructed to protect YOUR profits. It combines the desirable features of steel pipe—rigidity and pressure strength—with Saran's unusual resistance to most corrosive chemicals, solvents, and erosion. Another advantage is ease of field fabrication. For general service, Saran Lined Steel Pipe can be used at temperatures between  $-40^{\circ}$  and  $190^{\circ}\text{F}$ .

Saran Lined Steel Pipe comes in maximum lengths of 10 feet and in sizes from 1 to 4 inches. Plug valves and fittings, also Saran Lined, include elbows, tees, companion and reducing flanges, and gaskets. AVAILABLE IMMEDIATELY. Write us today for further information concerning Saran Lined Steel Pipe and how it can solve your problem. Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

**SARAN LINED PIPE COMPANY**  
702 Stephenson Building  
Detroit 2, Michigan

Offices in: New York • Boston  
Philadelphia • Pittsburgh • Chicago  
Tulsa • Indianapolis • Houston  
San Francisco • Los Angeles  
Portland • Seattle • Toronto  
Denver • Cleveland



be eliminated. These driers are ruggedly constructed for long, trouble-free service under production conditions, and are unconditionally guaranteed by the manufacturer. Adaptable for racks or trays, and also available in conveyORIZED models for large scale production. Models are available for steam, gas, or electrical operation. A temperature control thermostat and damper arrangement are incorporated in the machine for best results in drying small or heavy bulky parts.

### New Blasting Abrasive

*Hickman, Williams & Co., Dept. MF, Cleveland, Ohio.*

A special treatment of the carbon to provide a softer, more malleable body is the feature of a new shot and grit now offered for metal cleaning under the trade name of Permabrasive. Because of its softer body, the new shot and grit retains its original impact value longer, extends its useful life before final breakdown and causes less abrasion on machines and parts, it is claimed. This results in the reduction of "bottleneck" stoppages for repair and assures a more continuous, more efficient operation, with lowered cleaning costs, according to this firm. Manufactured in both Cleveland and Chicago, the new abrasive is available for immediate shipment.

### Diaphragm Valves

*C. A. Norgren Co., 222 Santa Fe Drive, Dept. MF, Denver 9, Colorado.*

In their new Series 62-A diaphragm relief valve, this firm offers the user high volume relief without blow-down, it is claimed. This line of valves is suited to lines carrying air, cold water,



oil, insecticides and similar liquids at pressures up to 250 psi.

Operation is simple, positive, fully automatic, according to the firm. When pressure exceeds the relief setting, diaphragm and valve seat are raised, opening the valve and releasing air or liquid thru the outlet port. Surplus liquids can be discharged to supply tank by piping the outlet port.

All parts in contact with the air or fluid handled are brass. Synthetic rubber diaphragm, reinforced with nylon cloth, is highly resistant to oil insecticides and other fluids for which the valve is recommended. Diaphragm extends to extreme outer edges of body and bonnet—held positively in place.

Regulating springs are available in six sizes for relief pressure ranges of: 2 to 15 psi; 15 to 50 psi; 40 to 75 psi; 75 to 125 psi; 125 to 250 psi; and 5 to 125 psi. Valves are available in  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1" pipe sizes.

Additional data is available from the manufacturer.

#### Leak Detector for Testing Tanks

General Electric Co., Dept. MF, Schenectady 5, N. Y.

Completely welded tanks made for holding liquids can now be rapidly tested for leaks, according to a recent G. E. announcement. To make certain there are no possible places for liquids to seep out, all welds can be checked by the portable G-E detector before the finished tanks pass from the assembly line.

This electronic instrument is said to be so sensitive that it can detect leaks small enough to release only one ounce of gas a century. The new in-



BECAUSE OF—

- Hard to Remove Buffing and Polishing Residues
- Drawing and Stamping Compounds
- Slushing Oils
- Stubborn Solid Dirt Particles
- Alkaline Damage

## Try A PRECLEANING DIP IN MAGNUSOL

**O**FTEN a 30-second precleaning dip in Magnusol makes all the difference between a good and a bad plating job. All solid dirt and most stubborn residues will vanish in the water rinse after the dip.

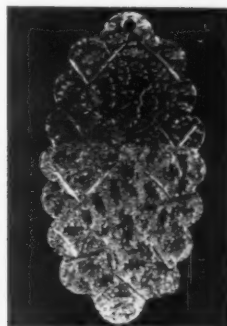
If you're cleaning before plating, final alkaline cleaning to give you a chemically clean surface will be faster and better, when dirt that resists alkaline cleaning are first removed in Magnusol.

If you're cleaning for painting, lacquering and most other finishing operations, the Magnusol dip is usually all you need to get a satisfactory surface for your finish.

Magnusol precleaning is economical as well as simple. Work is dipped in or sprayed with the solution, then rinsed clean with a water spray. No heat is required.

Magnusol is supplied as a concentrate to be used with kerosene or safety solvent in the proportion of one part to six or eight parts of the diluent. It is safe for all metals, and is non-toxic and non-inflammable.

Ask us to arrange for a demonstration of what Magnusol can do on your work, right in your own plant.



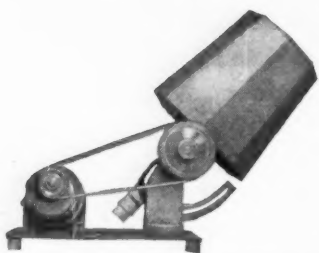
◀ Buffed brass plate, lower portion dipped in Magnusol solution and water rinsed. Note how thoroughly heavy dirt load has been removed from the rough background.

**MAGNUS CHEMICAL COMPANY** • 11 South Ave., Garwood, N. J.  
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.  
Service representatives in principal cities

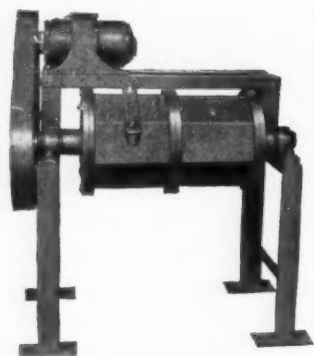


ON SMALL JOB LOTS

## FINISHING COSTS TUMBLE



**TILT-TYPE BENCH MODEL** — motor or belt driven. Adjustable elevation. Steel, wood, rubber lined or alloy metal barrels.



**HORIZONTAL FLOOR MODEL** — light duty for bulk tumbling and burnishing of small parts.

... when you use a Henderson Oblique Tilt-type Bench Model Tumbling Barrel.

Ideal for SMALL-LOT FINISHING and SAMPLE LOT PRODUCTION of jewelry, clock parts and similar products requiring a *quality finish at minimum cost*. Widely used in laboratory experimental work.

ALSO HORIZONTAL TUMBLING BARRELS — both light and heavy duty for small-lot and quantity production.

Tumbling barrels for every purpose or, made to order to meet your special requirements.

Write now for further information.

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

**THE HENDERSON BROS. COMPANY**  
135 SOUTH LEONARD ST. WATERBURY 85, CONN.

strument enables a fabricator to detect the smallest of leaks in a tank, and these can be repaired before the unit is shipped.

### Pouring Spout for Acid Bottles

Fisher Scientific Co., Dept. MF, 717 Forbes St., Pittsburgh 19, Pa.

Safety and convenience are provided



in an otherwise hazardous, troublesome laboratory task by the new Fisher Safety Pouring Spout for use with standard 5-pint acid bottles or one-gallon jugs.

The new spout has an ingenious design which vents air into container as liquid is poured out, thus preventing the danger of splashing, spilling and "after-drip" common when pouring directly from bottle, it is claimed. The new spout is furnished with washer by means of which it is adaptable to fit all types of acid bottles now used, and with closure cap. It is made of polyethylene, a plastic that is resistant to all ordinary acids and alkalis as well as most organic compounds under 60 deg. C.

### Compact Steam Cleaner

Kelite Products, Inc., Dept. MF, Box 2917, Terminal Annex, Los Angeles 54, Calif.

Measuring only 44" wide, 24" deep, and 45" high, the new Kelite Model Q Steam Cleaner has up to twice the rated capacity of competing models, it is claimed.

The compact design and high output (110 gals. of solution vaporized per hr.) was achieved by simplification and rearrangement of all elements. All



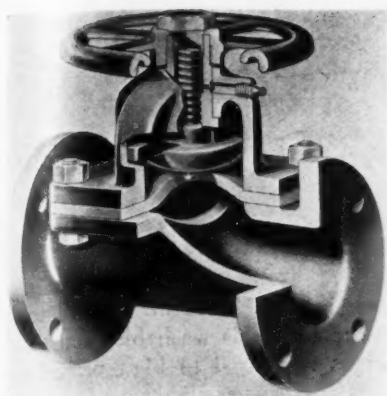
basic Kelite features, such as automatic type pump, all-steel welded construction, automatic fuel regulator, automatic safety shut-off, high velocity nozzle, aerated gun grips, and other patented Kelite devices, are incorporated in the Model Q.

The Model Q Kelite Steam Cleaner is a completely enclosed cabinet type, requiring no special skills to operate, it is said. The stationary model weighs 465 pounds. Portable models are also available at higher prices.

### Valve Permits Handling 66° Bé Sulphuric Without Leaking, Dripping or Sticking

Hills-McCanna Co., Dept. MF, 3025 North Western Ave., Chicago 18, Ill.

The development of a new plastic diaphragm for use in Hills-McCanna (Saunders Patent) diaphragm valves has been announced by the above firm, who claim that the new material makes possible the handling of 66° Bé Sulphuric Acid without the leakage, dripping or sticking problems generally encountered in valving this material. While this valve is already widely used in a broad variety of corrosive services, the introduction of the new diaphragm material opens a completely new field in which the valving problems have never before been satisfac-



torily answered, according to the firm.

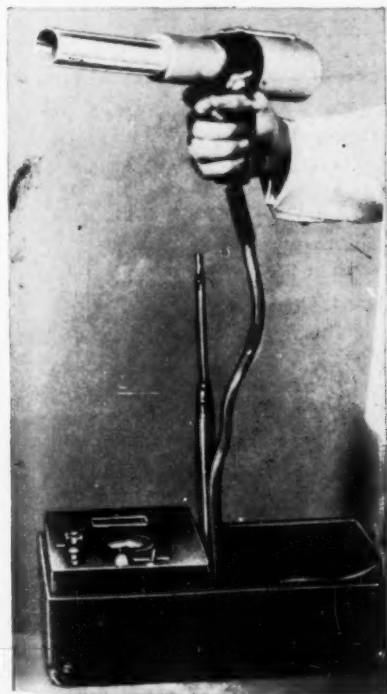
At the present time it is the plan of the company to furnish these valves in sizes from  $\frac{1}{2}$ " through 4", with a choice of cast iron, cast steel, Durimet, or glass lined bodies. All but the glass lined will be available with flanged or screwed ends. The glass lined being available only with flanged ends. All sizes are suitable for pressures to 100 psi and temperatures to 125° F.

Detailed information concerning the valve will be furnished by the manufacturer.

#### Electrostatic Sampler for Airborne Particles

Mine Safety Appliances Company, Dept. MF, Pittsburgh 8, Pa.

The new M.S.A. electrostatic sampler for quantitative sampling of airborne dusts, fumes, and smokes, is illustrated and completely described in a 4-page bulletin, No. CT-9, published by this firm.



# BLAKESLEE SOLVENT VAPOR DEGREASERS

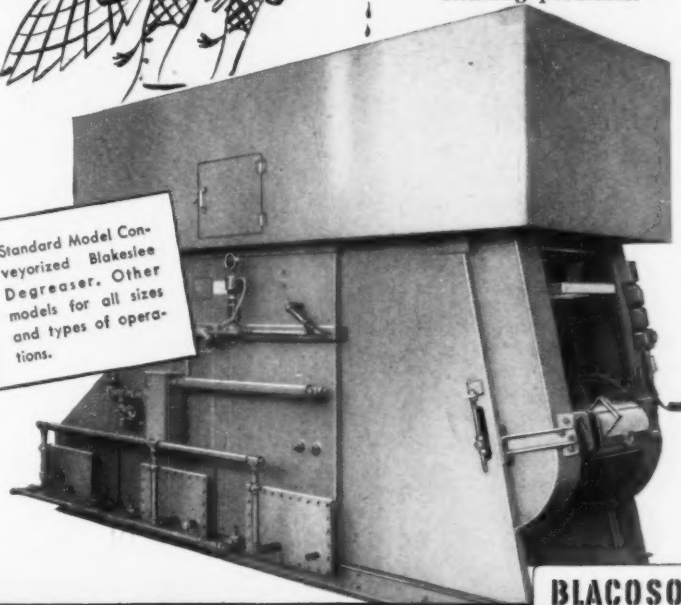
## USE LESS SOLVENT

And that's not all... In Blakeslee Solvent Vapor Degreasers, metal parts are rendered chemically clean and dry in just a few seconds. Cracks and spot welded seams come out 100% grease-free. This means savings in time, labor and rejects.

Blakeslee, pioneer in mass production cleaning methods, is the logical source to answer your cleaning problems.



Standard Model Conveyorized Blakeslee Degreaser. Other models for all sizes and types of operations.



### G. S. BLAKESLEE & CO.

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS  
NEW YORK, N. Y. TORONTO, ONT.

**BLACOSOLV**  
DEGREASERS AND SOLVENT

**NIAGARA**  
METAL PARTS WASHERS

Designed for high efficiency atmospheric sampling for all types of particulates in the ceramic, electrical, steel, and chemical processing industries, the electrostatic sampler has been accepted by many safety and industrial hygiene agencies of the U. S. federal, state and local governments.

The electrostatic sampler is equipped with a portable sampling head for easy sampling of the atmosphere at various levels. A special high voltage cable facilitates coiling and permits the use of an extension cable. A retractable stand provides support for the sampling head when remote operation is unnecessary. The sampler is equipped with a specially designed power pack, capable of producing 10,000 to 15,000

volts DC, and an accurate high voltage indicator. The electrostatic sampler, together with a complete sampling tube kit is furnished in a convenient portable case.

#### Improved Glass-Pipe Coupling

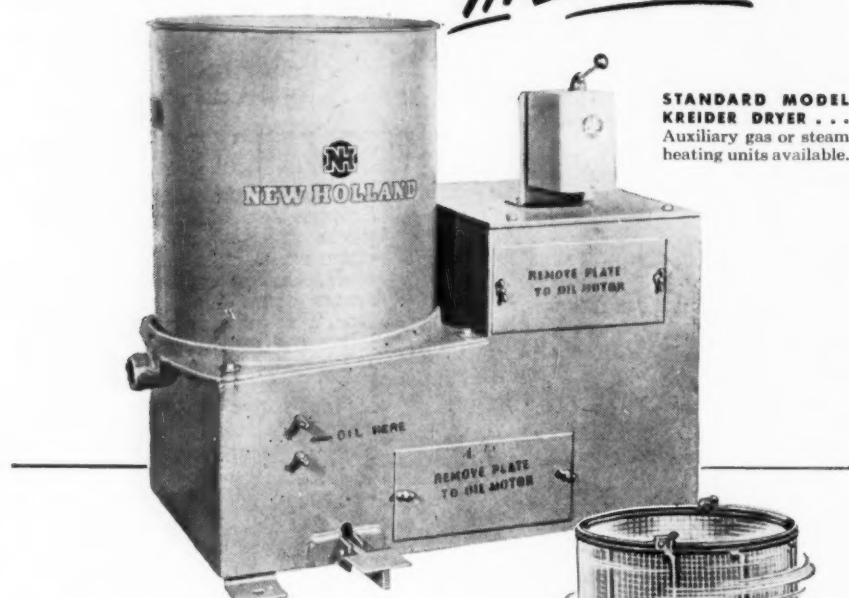
Fischer & Porter Company, Dept. MF, Hatboro, Pa.

The above firm announces a new threaded metal coupling, for use with Pyrex glass pipe lines. The new coupling greatly simplifies the installation of glass piping by replacing three-bolt triangular metal flanges. The use of wrenches is no longer necessary and perfect alignment is assured, it is claimed. The danger of breakage due



## SPIN-DRIES SMALL PARTS

**IN 2 MINUTES\***



**STANDARD MODEL  
KREIDER DRYER . . .**  
Auxiliary gas or steam  
heating units available.

### Pays for itself in time saved . . .

**Dries Faster.** Takes as little as 35 seconds to whirl parts completely dry—no more than 2 minutes for 50 pounds—drying basket (capacity 1140 cu. ins.) spinning at 625 rpm.

**Dries Better.** There's no marring or scarring with a Kreider Dryer. It produces smooth, evenly dried surfaces with longer lasting lustre.

**Dries More Economically.** Simple in design . . . rugged in construction, the Kreider Dryer is operated by one man. Uses less than one hp. Occupies less than 6 square feet floor space.

**See for Yourself!** Write today to Department M-99 for an illustrated 4-page folder . . . also addresses of installations near you, where you can see a Kreider Dryer in action.

New Holland Machine Co., New Holland, Pa.

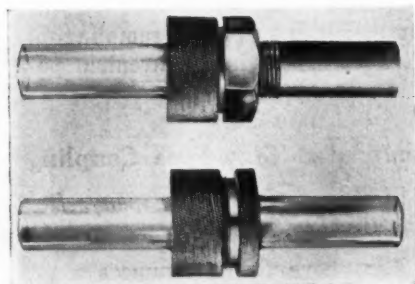
### \*Only 2 simple steps required . . .

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON".

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.



**NEW HOLLAND KREIDER DRYER**



to uneven take-up is eliminated, and installation time is reduced up to 60% in comparison with alternate methods. Metal couplings are available from stock in sizes  $\frac{1}{4}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", and 1" for making glass-to-glass or glass-to-metal connections.

### Surface Finish for Aluminum or Other Heat Reflective Surfaces

The Sauereisen Cements Co., Dept. MF, 1045 North Canal Street, Pittsburgh 15, Pa.

The research work for this new coating was undertaken at the request of a large electrical manufacturer, and is used on electric grills to reflect heat and protect delicate table tops. However, this new surface finish has many other uses besides its original application on electric grills, it is claimed; as window paint it gives beautiful frosted effects, and it gives protection to furnaces and waterheaters.

This new coating is called Sauereisen

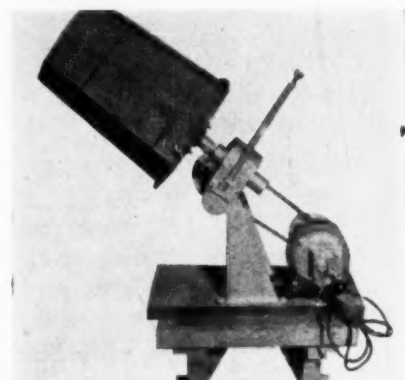
Cement Coating No. 7 and is made of a scientifically formulated Silicate base, has a porcelain-like appearance, and is very easily applied by spraying or brushing, it is claimed. It can be colored with organic and some inorganic pigments, and the coating withstands temperatures as high as 500°F., according to the firm. When plunged from high heat into cold water the No. 7 coating is said to be shockproof. It is washable, non toxic, and as compared to high priced silicone paints, very inexpensive, it is claimed.

Further details are available from the manufacturer.

### Small Burnishing and Tumbling Machine

J. Szeremany, Dept. MF, 58 Lexington Ave., Maplewood, N. J.

Recently announced by this concern is a small burnishing and tumbling



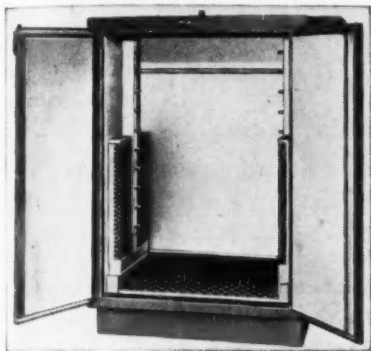
unit for barrel operations on jewelry and similar small items. The unit can be used with interchangeable barrels for burnishing, tumbling, sawdust drying, deburring, and plating. Three speed ranges are available by means of a cone pulley drive, 17-33-57 r.p.m. Both steel and wood barrels are available for use with this machine, including stainless steel and lined barrels, in two basic sizes—14" base dia. x 11" throat x 12" long for the larger size, and 10" base dia. x 7" throat x 8" long for the smaller size. Barrels can be quickly interchanged. Bench space for the entire unit is only 18" x 14". The extreme ease of operation and versatility of this unit should make it a valuable piece of equipment in the shop where small lots of parts must be barreled economically.

## Electric Ovens for Curing Plating Rack Coatings

Belke Mfg. Co., 947 N. Cicero Ave.,  
Chicago 51, Ill.

Accurately controlled temperatures necessary for effective curing of plating rack coatings are maintained by electric ovens developed by the above concern.

Developed especially to provide the



necessary preheating and curing facilities for coating plating racks with Belke Universal Plastic and other coatings, these ovens also provide controlled heating facilities for many other users in various types of plants and laboratories.

Temperature is maintained at any preset temperature between 300 and 400° F. by the automatic temperature control. Other temperature ranges can be furnished if specified. The ovens are insulated all around with three inch thick glass wool to conserve heat. Easily replaceable, long service, Nichrome "5" heating elements are mounted on the bottom and side walls for uniform heating.

Ruggedly constructed of sheet steel and angle iron throughout with finish of high baked aluminum paint on inside and high baked blue-gray enamel on outside. Completely wired and ready to hook up for most electrical service requirements. Available in three standard sizes or made to specification.

### Self-Priming Protective Coating

U. S. Stoneware Co., Dept. MF,  
Akron 9, Ohio.

This firm has just announced a new addition to its line of Tygon protective coatings. The new coating, designated as Series "K" is a self-priming vinyl-base paint that adheres tightly to metal, wood, or concrete, it is claimed.

Tygon Series "K" self-priming paint

# TOUGHEST UNICHROME COATING YET!



Now, with COATING 218X,  
you'll spend even less  
to maintain racks

Compare this plastisol Unichrome coating for resistance to vapor degreaser, hot caustic and chromic acid solutions. You'll see why Coating 218X stands up longer, saves you money in any plating cycle. For among the chemicals used in plating cycles, those three are most destructive to rack coatings. Yet, results in our own laboratory, confirmed in that of a large automotive producer, prove they have negligible effect on Coating 218X!

Along with this remarkable chemical resistance goes extra physical toughness. Coating 218X has flexibility that absorbs hard knocks without chipping. Surface hardness resists accidental cutting and rough handling. Because it is free-rinsing, it permits continuous cycle operation with minimum dragout.

Write for new prices and data. Remember, if you have no baking facilities, you can still profit from the cost-cutting advantages of Coating 218X. Nearby applicators can serve you. We'll send you names.



Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.  
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

was developed primarily to fill the need for an easily-applied protective coating to resist corrosive conditions not sufficiently severe to warrant the use of the multiple coat series of Tygon Paints. For normal conditions two to three coats of Series "K" provides effective and long-lasting protection. May be brushed or sprayed; they air-dry quickly or may be baked.

Tygon Series "K" shows excellent resistance to corrosive fumes of almost all acids and alkalis; as well as to excessive humidity, grease, oil, and alcohols, it is claimed. It is softened by aromatic hydrocarbons, ketones and esters. It is non-oxidizing, non-inflammable when dry, and possesses an upper temperature limit of approxi-

mately 200° F., according to the firm.

It is available in black, white, clear, gray, red, green and aluminum.

### Redesigned 48" x 48" Wheelabrator Tumblast

American Wheelabrator & Equipment Corp., Dept. MF, 555 S. Byrkit St., Mishawaka, Indiana.

The 48" x 48" Wheelabrator Tumblast, an airless centrifugal type blast cleaning mill, has been redesigned to incorporate new features and improvements, according to this firm.

The machine has an operating load capacity of 20 cu. ft. and is particularly adaptable to steel casting and steel forging plants where gruelling applica-

# GLOBE Burr-Rite Senior

Cuts Costs...Increases Production!



For  
Mass Production  
Precision  
De-Burring

**Produces Finer Finishes!  
Saves Man-Hours of Hand Labor!**

## HUPP'S FREE Experimental Service

Hupp's Experimental Engineering Laboratory will show you how to cut finishing costs. Send samples of parts to be processed along with finished part. There's no charge or obligation.

• Globe Burr-Rite Senior—the latest advancement in precision de-burring—finishes ferrous or non-ferrous parts and die-castings better and at lower cost. When desired, double or triple compartments permit de-burring and polishing at the same time. Larger, quick-opening aluminum doors and new hoist pan assure speedy loading and unloading. Write for specifications sheet.



Hupp Manufactures a Complete Line of  
Tumbling Barrels and De-Burring Machines  
Dependable for 47 Years

# HUPP CORPORATION

GLOBE STAMPING DIVISION

1250 WEST 76th STREET • CLEVELAND 2, OHIO

SERVING INDUSTRY SINCE 1902

tions for blast cleaning machines are encountered, it is claimed.

Bulletin No. 134-A, complete with photographs, drawings, and data on the features, construction and specifications of this newly redesigned machine may be obtained by writing directly to the manufacturer.

## Small Plating Rectifier

*Electronic Rectifier Co., Inc., Dept. MF, Rochester 2, New York.*

The Model N30VP Rectifier shown, provides an excellent source of D. C. power for small plating shops, jewelers, and experimenters. It also serves as an auxiliary power supply for special

jobs in the larger shops. This unit incorporates most of the features of the larger, more expensive rectifiers while retaining a modest selling price.

This rectifier provides continuously variable voltage from 0 to 8 volts, by means of a powerstat variable voltage transformer. Full-wave rectification is provided by heavy-duty selenium rectifier stacks which have long life and under normal use should seldom require replacement, it is claimed.

A suitable 3% accuracy voltmeter and ammeter are installed on the front panel to indicate the D. C. output of the unit. Connections are made to a terminal board conveniently located inside the hinged cover.



The entire unit is self-contained, arranged for wall mounting, and measures 10½" wide x 17" high x 5½" deep. Finish is in durable baked enamel.

## Chemical Immersion Polish for Aluminum Alloys

*Colonial Alloys Co., Dept. MF, Phila. 29, Pa.*

Aluminum and its alloys, including those alloys containing copper as well as assemblies of alloys, can now be mirror-brightened and protected in a few minutes by means of simple immersions in aqueous solutions, it is claimed. These treatments either in the as-brightened or as-protected conditions are excellent bases for paints and lacquers, according to this firm.

The operation consists of a series of acid-proof and common steel tanks, several of which are used hot. The entire time of the cycle is as low as 5 minutes. The resultant finish is clear, resembling reflective anodizing. Chemical control is simple and a chemist is not required. Cost of chemicals is nominal and they have a good life expectancy, it is claimed. Much work, depending on the size and shape of the parts, can be handled in bulk, as in baskets.

The process is available to industry, and arrangements can be made to view this process in commercial production. For those who desire it, their production can be handled on a contract basis in Philadelphia. Samples which are submitted will be processed free of charge and returned for evaluation.

Part of this process will produce



passivated mirror-type finishes, which, if followed by anodizing and coloring produces brilliant colored effects simulating most any of the brightly polished metals (gold, silver, copper, brass, chromium etc.) or other colors. The corrosion resistance is greater than the best plated metals, it is claimed, and no after-lacquer is required.

Castings, especially those containing silicon cannot be finished in accordance with the above claims.

Specify if sample specimens are to be mirror-brightened only, mirror-brightened and protected (by dip), mirror-brightened and anodized clear, or mirror-brightened and anodized in color, designating the color. No charges are involved for samples.

#### **Cleaner-Conditioner and De-ruster for Ferrous Metals and Aluminum**

*Oakite Products, Inc., Dept. MF, 118 Thames St., New York 6, N. Y.*

This firm has announced the development of a new, acid-type cleaning and surfacing-conditioning material, Oakite Compound No. 33, designed to remove rust, oxides, grease, oils and shop soils from metal surfaces, and to prepare ferrous metals and aluminum for sure-grip adhesion of paint, lacquer and enamel finishes.

Oakite Compound No. 33, the manufacturers report, possesses notable detergent and solvent properties, and may be used for prepaint cleaning of large steel or aluminum parts or sheets by wiped-on-method. Dilute solutions are applied at room temperature by brush or cloth, allowed to soak on surfaces briefly, then followed by rinsing and hand-wiping to complete the operation. For washing medium-size or small parts, Oakite Compound No. 33 solutions may be employed in tanks or in acid-resistant washing machines at working temperatures approximately 140°F. Water rinsing and quick drying complete the cleaning-conditioning cycle. Where light rust is the principal soil on steel parts being processed, the use of Oakite Compound No. 33 may effect considerable time and cost-savings by eliminating the need for separate pickling and rinsing operations.

Readers may secure additional information, without charge, concerning this new cleaning-conditioning material.

# CHROMIC ACID

## 99.75% PURE



**SODIUM BICHROMATE  
POTASSIUM BICHROMATE**

## MUTUAL CHEMICAL COMPANY OF AMERICA

**270 Madison Avenue, New York 16, N. Y.**

#### **Larger Steel Balls by Pioneer**

*Pioneer Steel Ball, Inc., Unionville, Conn.*, has announced an increase in size range from  $\frac{3}{8}$ " to  $\frac{3}{4}$ ". The installation of new ball processing equipment enables the company now to offer carburized steel bearing balls from  $\frac{1}{16}$ " to  $\frac{3}{4}$ ".

This doubling of the range of sizes marks the third expansion program in less than three years. Originally lodged in a one-building plant of 4,000 square feet, the company now occupies factory and office buildings totaling over 30,000 square feet.

In addition to carburized bearing balls, Pioneer manufactures bronze balls, stainless steel balls, burnishing

balls and other metallic shapes for use in burnishing or tumbling barrels.

Officers are *N. Martinelli*, president; *James J. Peta*, vice president; *J. Howard Donahue*, secretary. These men have a combined experience in the ball industry of better than a half century.

### FINISHING COURSES

#### **Electroplating Correspondence Course**

*Joseph B. Kushner*, Metal Finishing Engineer of New York and Stroudsburg, Pa., announces that he is now accepting enrollments in his personally conducted and supervised correspond-

# NO SHUT DOWN

to carbon treat solution with . . .

## SPARKLER *horizontal plate* FILTERS

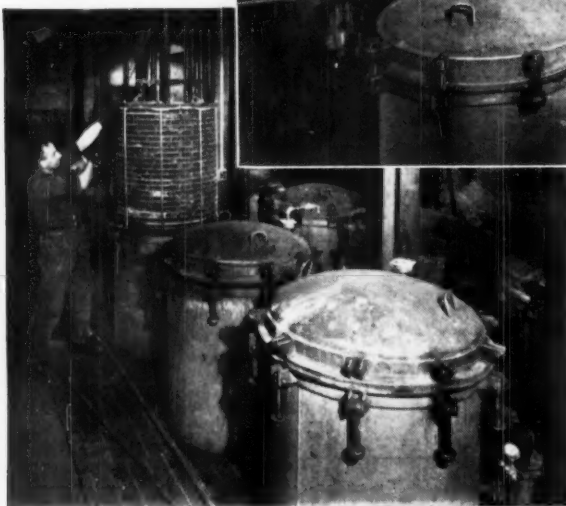
Only a few minutes are required to lift out the horizontal plate assembly in a Sparkler Filter and drop in a clean set of filter plates and production is under way without appreciable interruption.

Tanks are given a carbon treatment without shutting down production in the battery installation shown here. One or two filters are cut out of the line, drained, cleaned and dressed with clean filter papers. The proper amount of carbon is mixed with water in a stand-by tank and recirculated through the filters thus depositing the carbon on the plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

Sparkler Horizontal Plate filters give absolutely sharp filtration at all stages of the cycle.



A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.



**SPARKLER MANUFACTURING CO., MUNDELEIN, ILLINOIS**

ence course in modern electroplating, "Electroplating Know How."

The Course, based on many years of experience in the field, was designed by Mr. Kushner to give practical electroplaters a solid foundation in the basic fundamentals of modern plating practices so that they can carry on their plating operations from a more up to date and scientific point of view and advance themselves in their work. It is also of value to plant executives who want to know more about their plating operations, control chemists who want a more practical view of the

subject, and supply men who want to give themselves a good background in the techniques of modern electroplating.

Written in an informal, easy-to-follow style, "Electroplating Know How" gives in a friendly, easy way the information that teaches a man to "think" plating. Theory is mixed with practice in a novel manner that makes learning a pleasurable experience for the student.

The course consists of over 500 pages of material divided into a series of 10 individually bound, printed and

illustrated lessons, titled as follows: 1) Basic Principles of Plating; 2) Polishing and Buffing; 3) Cleaning and Pickling; 4) The Plating Baths; 5) The Alloy Plating Baths; 6) Metal Coloring and Lacquering; 7) Plating on Non-Conductors; 8) Testing plated Deposits; 9) Special Plating Techniques; 10) The Electroplating business.

"Electroplating Know How" may be taken formally with examinations and experiments, for a certificate, or informally, as a reading, study and survey course to increase the students knowledge of the subject. The course is given over a period of 4 months though a student may take up to 1 whole year to complete it if he or she so desires.

Inquiries for complete details on the course may be made by writing directly to Joseph B. Kushner, Metal Finishing Engineer, Stroudsburg 1, Pa.

### N.Y.U. Graduate Courses in Surface Technology

In response to continuing demand, the New York University Department of Chemical Engineering will again offer a series of graduate courses in Surface Technology. A brief description of each course is given below:

Ch.E. 174-175. Surface Finishes. Prerequisite: Ch.E. 71, 81. *Adjunct Associate Professor Kronstein*. Full course, first and second term. Wednesday, 7:00-9:05.

A study of the principles involved in protective, decorative, and functional finishing. Economic factors. Forms of finishing problems. Types of surfaces, types of finishes, methods of application.

Specifications, test methods. Research, production, and control methods. Advanced finishing problems.

Ch.E. 176-179. Surface Finishes Laboratory. Prerequisite: Ch.E. 175. *Adjunct Associate Professor Kronstein*. Full course, first and second term. Friday, 7:00-10:00.

A laboratory introduction to the basic processes of decorative and protective finishing. The various methods of evaluating and testing surface finishing products and their application are studied.

Ch.E. 301-302. Research. *Adjunct Associate Professor Kronstein*. Properly qualified students may pursue experimental studies in connection with the preparation of theses. The

work is to be carried out under the direction of Professor Kronstein.

The registration dates for these courses are as follows:

First term: Wednesday, September 14 through Friday, September 16, 1949.

Second term: Wednesday, January 25 through Friday, January 27, 1950.

Registration is held at South Hall, University Heights campus, 181st Street and University Avenue, Bronx, New York, from 6:30 to 8:30 P.M.

For any additional information address Henry J. Masson, Assistant Dean, in Charge of Graduate Division, New York University, College of Engineering, University Heights 53, N. Y.

### City College to Conduct Course in Practical Electroplating

The College of the City of New York, School of Technology, will offer a course in Practical Electroplating for the Fall Semester. The course will be given on Monday Evenings from 7:00 to 9:00 P.M. Registration will be held September 16th and 19th in the evening.

The primary objective of the course is to provide commercial electroplaters with a sound understanding of the principles underlying their work. For details, address Prof. W. Willig, City College, New York 31, N. Y. or phone WA 6-5400 during business hours.

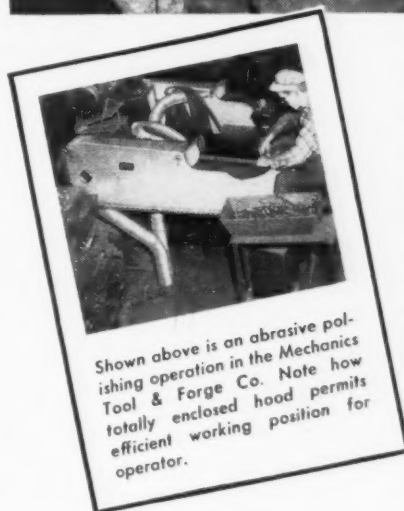
## Business Items

### Moffatt to Represent Udylite in Rochester

W. H. "Tye" Moffatt has been appointed Field Representative for The Udylite Corporation in Rochester, New York, according to an announcement by L. V. Nagle, Udylite Vice-President.

Mr. Moffatt joined the Udylite Corporation in 1941 as a member of the laboratory staff. After a period in the armed forces, he returned to Udylite in 1946 and was made Technical Service Engineer for the State of Michigan. During the past year, he has represented Udylite as Sales and Service Engineer for New York State.

A native Detroit, Mr. Moffatt attended the University of Detroit, Ontario College of Pharmacy, University of Toronto, and the Detroit Institute



Illustrating the ingenuity of KIRK & BLUM Engineers is a recent installation of grinding hoods at the Mechanics Tool & Forge Co., Sabina, Ohio. To fit space limitations and to avoid interference with lights, all dust collecting piping was installed in trenches below floor level. In doing this, Kirk & Blum grinding hoods were adapted to "top-of-wheel" grinding which offers many advantages in the grinding of hand tools and other parts. Call Kirk & Blum for dust collection systems and metal fabrication. The Kirk & Blum Mfg. Co., 2859 Spring Grove Ave., Cincinnati 25, Ohio.

FOR CLEAN AIR... THE ~~UNIQUE~~ TOOL

**KIRK AND BLUM**  
DUST CONTROL SYSTEMS



W. H. Moffatt

of Technology.

Mr. Moffatt, a member of the American Electroplaters Society, is transferring his affiliation from the Detroit Branch to the Rochester group. He will reside at 51 Fernwood Park, Rochester 9, New York.

### Gold to Represent Daniels in Phila. Area

Walter C. Gold, Inc., 112 North Front St., Philadelphia, Pa., has been appointed representative in the Philadelphia area by the Daniels Plating Barrel and Supply Co., Newark 5, N. J., for sales and service of Daniels plating barrel equipment. This territory covers Pennsylvania, east of Pittsburgh.

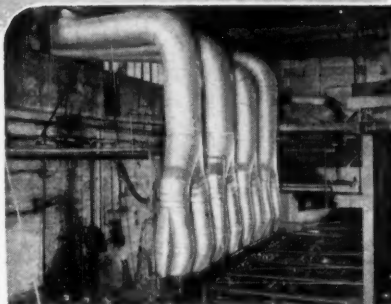


## Ohio FUME AND DUST REMOVAL SYSTEMS TANGIBLE DOLLAR SAVERS

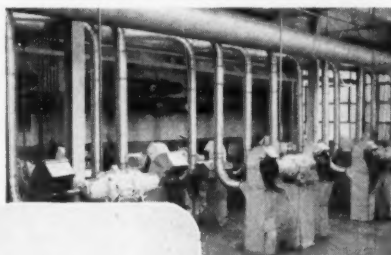
● Records on hundreds of Ohio Blow Pipe jobs prove without question that production output materially increased and employee absence and complaints radically decreased after the installation of an Ohio System for ventilation of fumes from plating and rinse tanks and dust collection from grinding, polishing and buffing.

Ohio Systems are not standard fit-all systems. They are designed and engineered to meet your individual requirements. Ohio engineers, thoroughly experienced in their field, make a careful, exacting survey of your plant and an analysis of conditions and then plan the system that will meet most efficiently your special needs and conditions.

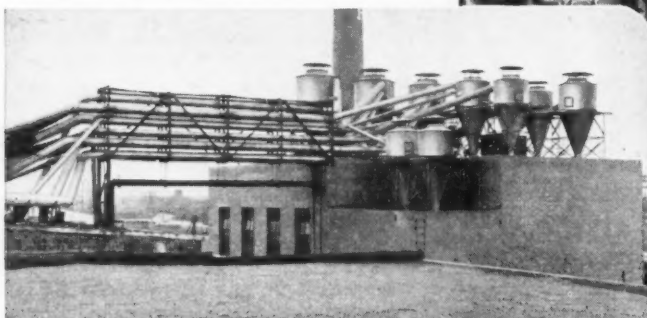
Call, write or phone today and let Ohio engineers make a survey and give you, without obligation, an estimate.



Fumes Removal Installation in Plating Room



Dust Collecting System for Buffing Machines



Cyclone Type Dust Collectors

**Ohio BLOW PIPE CO.**  
ENGINEERS AND MANUFACTURERS  
1725 DOAN AVENUE • CLEVELAND 12, OHIO



William E. Mahin

the Research Foundation in 1947 Mahin was in charge of metallurgical engineering at Westinghouse Electric Corporation, Pittsburgh, Pennsylvania.

Born November 5, 1906, in Baltimore, Maryland, Mahin received his B.S. degree in metallurgy at Notre Dame in 1928, and in 1933 received a degree of M.S. in metallurgical engineering from Carnegie Institute of Technology, Pittsburgh.

In addition to his positions at the Foundation and Westinghouse, Mahin was in charge of metallurgical research for the Vanadium Corporation of America and has been a metallurgist at Inland Steel Company.

He is vice chairman and program chairman of the Chicago Section, American Society for Metals, and program chairman of the Chicago Section, American Institute of Mining and Metallurgical Engineers. He is a member of the national publications committee of the American Society for Metals.

### Severance New Chief Chemist for Ceilcote

The Ceilcote Company, Rockefeller Building, Cleveland, Ohio, announces the appointment of *W. A. Severance* as Chief Chemist in charge of Research and Development, Product Control and special customer problems in the field of Corrosion-Proofing. Mr. Severance was formerly with the Parker Appliance Company, Cleveland, Ohio.

### Bacon Heads Chicago Technical Societies Council

*R. H. Bacon* has been elected president of the Chicago Technical Societies

### Rockwell Lime Co. Purchases Allwood Lime Co.

The Rockwell Lime Company, with general offices located at 228 N. La Salle St., Chicago 1, Ill., and quarries located at Manitowoc, Wisconsin, recently announced that the firm has purchased the Allwood Lime Co., also located at Manitowoc, Wis.

In his announcement of the recent purchase, *Mr. E. P. Bostler*, secretary and treasurer of the Rockwell Lime Co., mentioned that the two plants and quarries in Manitowoc will merge and produce domestic "Vienna" lime for abrasive use in compositions and steel polishing. Plans of the Rockwell Lime Co. include increased production and plant modernization to meet both do-

mestic and foreign demand for their product in the metal finishing and other industries.

### Mahin New Research Director at Armour

*W. E. Mahin*, chairman of metals research at Armour Research Foundation of Illinois Institute of Technology, has been named director of research, it was announced today by *Dr. Haldon A. Leedy*, director of the Foundation.

Mahin will head a group of 411 scientists, engineers, and technicians who are at present working on 125 active research projects for industrial and government sponsors. It is the largest of the Foundation's three divisions.

For ten years previous to his joining

Council for 1949-50. He is vice president of the Industrial Advertising Agency of *Kreicker & Meloan, Inc.* and president of *R. H. Bacon & Co.*, Business Paper Editorial Service. For the past 25 years he has been active in engineering society work in Chicago, having been Chairman of the Chicago Section of the American Society of Mechanical Engineers in 1928 and President of the Chicago Engineers Club in 1947.

The Chicago Technical Societies Council is made up of some 50 scientific, engineering and technological societies representing approximately 18,000 members.

#### Atlas Mineral Products Dedicates New Research Laboratory

The Atlas Research Laboratories were dedicated at Mertztown, Pa., on August 20th as a memorial to the late *Maximillian F. Wirtz*, who founded the firm in 1892. The ceremony was featured by the unveiling of a plaque in memory of the founder by his widow, *Bernardine Wirtz Dorr*.

In an address "The Employee's Stake in Research," *George L. Wirtz*, President and son of the founder paid tribute to his father's vision and research ability. He related many incidents in the growth of the firm, a leader in the field of protective coatings, linings, cements and pipe jointing materials. This company is one of the few manufacturers of materials for chemical construction that supports a modern adequately equipped research laboratory. *Joseph A. Snook*, General Chairman of the activities, opened the new laboratories for inspection by the

## OBTAIN BETTER RESULTS!

### USE BUNATOL

In the field of rack insulation BUNATOL No. 1000 Paste has proven itself to be the quality insulation at the lowest price.

This free flowing 100% solids Paste is so simple to handle that the costly problem of rack insulation is quickly solved. If you have an oven to bake racks, Paste insulation can actually be used at less cost, and with remarkable long insulation life.

No. 1000 Paste cures to form an extra tough thick coating that will withstand all plating solutions and will not cut or abrade from rough handling. The insulation will last for months instead of weeks. It's permanently flexible and will not crack or peel on spring contacts.

Price is an object! First cost is much less and only a single Primer and a single top coat gives this remarkable result. It's the reason so many shops are turning to BUNATOL No. 1000. Less investment; less cost; so easy to use; racks completely insulated in a few hours.

Let us prove these points. Write for complete information and sample.

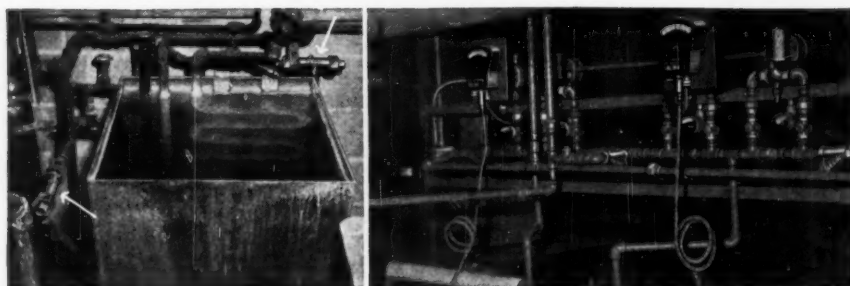
NELSON J. QUINN CO. TOLEDO 7, OHIO

# BUNATOL



At left—  
Part of the staff of the new Atlas Mineral Products Research Laboratory. Front row, left to right—George Gabriel; Joseph Dahle, Dir. of Research; James Fry. Back row, left to right—Carl DeLong; Willard Lantz; Walter Pascoe; William Rutter; Clifford Reinert; Richard Merkel; Carl Romig. Dr. Raymond Seymour, Technical Director, and Earl Erich were absent when the picture was taken.

employees and their families. The main office building and the Control Laboratory were also opened for this occasion. The new laboratories are housed in a two story brick building with over 5,000 sq. ft. of floor space. The unit laboratories are 15' x 15' with one chemist and an assistant assigned to each. A modern library with over 2,000 technical volumes and a Research Administration office occupy part of the second floor. Atlas mate-



**SARCO**

# Autothermic PLATING

You may not be able to make your present equipment completely automatic but you can make it automatic as far as temperatures are concerned at very small cost. That means that no matter how the temperatures and pressures of your steam and water supply vary, or how you are loading the tanks, the temperatures will be within a degree of the point at which you set the dials of the Sarco LSI Plating Control.

It also means that you can change the settings in a second for each tank and each load. This includes all kinds

of plating, and alternate heating and cooling. It means that you can read the temperatures on the big dial, custom-cut, for easy reading in your temperature range.

For wash tanks a low cost Sarco Thermoton hooked into the line like an elbow will hold the tank within a few degrees. And for degreasers you can select the Sarco Vapor-line Controls, or the Sarco TR-40 Cooling Control. To save steam, Sarco Traps and Strainers are recommended for each tank or steam coil.

ASK FOR SARCO BULLETINS ON PLATING CONTROL

**SARCO**  
SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

**SARCO COMPANY, INC.**

Represented in Principal Cities  
Empire State Building, New York 1, N. Y.  
SARCO CANADA, LTD., TORONTO 5, ONTARIO

270

rials of chemical construction are used on the outside of the building, walkways, laboratory benches, floors, hoods, and interior trim.

The Atlas laboratories are staffed by twelve chemists and technicians under the direction of *Dr. Raymond B. Seymour*, Technical Director, and *Joseph Dahle*, Research Director. The Control Laboratories now occupy a building in the plant area formerly used for both research and control. The Research Laboratories are far enough removed from the plant area to permit a certain amount of freedom from day to day plant problems which are handled by the control group. Atlas chemists hold membership in more than 20 technical societies, and they also serve on many technical committees of these

associations.

The Atlas laboratories are adequately equipped for the investigation of the problems related to corrosion-resistant materials. During the Open House, staff members explained the operation of physical testing apparatus, laboratory rubber mill, plastic molding press, electrometric titrimeter, Brookfield viscometer, spectrophotometer, laboratory homogenizer, SR-4 Strain Gauges and other specialized apparatus. It was also announced that a research project on the fundamental investigation of sulphur compound pipe joints was underway in cooperation with staff members of Lehigh University.

Following dedication ceremonies and Open House at the Atlas labora-

tories, an Outing was held at Hunsicker's Grove where a Clambake and sports were enjoyed by Atlas personnel.

## New British Firm to License Electropolishing Processes

A new British company has been formed for the purpose of licensing in the British Isles and in the British Commonwealth electrolytic processes for polishing, super finishing, and allied treatments for metallic surfaces.

*Modern Electrolytic Patents and Processes Ltd.*, has its Technical Offices at 46, Bryanston Street, W.1., and its Registered Office at 11, Ironmonger Lane, E.C.2., London, England.

The Chairman of the Company is *Colonel W. C. Devereux*, C.B.E., F.R.Ae.S., and the Managing Director is *Dr. H. E. Z. Gordon*, Ph.D., D.I.C., Chem.E.

The Company holds the rights for all electrolytic polishing processes patented by the *Battelle Memorial Institute*, Ohio, U. S. A., and by the *Societe Jacquet-Hispano Suiza*, Paris. The inventions are the subject of British Letters Patent numbered 526854, 552638, 558726, and 558727, and of a number of applications.

*Modern Electrolytic Patents & Processes Ltd.*, have extensive facilities for research and development, and are in a position to offer to their licensees a complete technical service and advice on installation of plant and operation of the process. *Dr. P. Jacquet*, the inventor of electrolytic polishing, is acting in an advisory capacity to the Company's Technical Staff.

## Dr. Heerin Named Research Director of Elgin Watch

*Dr. Martin H. Heerin*, for many years director of research for the Armour Research Foundation of the Illinois Institute of Technology, has been named director of applied research for the industrial products division of *Elgin National Watch Co.*, it was announced today.

*Dr. Heerin* will headquarter at Elgin's industrial products division in Aurora, Ill., where his initial assignment will be to supervise research and product improvement concerned with the firm's growing activities in the fields of abrasives, precision products and industrial sapphires.

*Dr. Heerin* had been associated with Armour research for the past 10 years



He obtained both his Master's and Doctor's degrees at the University of Iowa. A renowned chemist, he founded the National Registry of Rare Chemicals while chairman of Armour's chemistry and chemical engineering department.

#### Magnesium Ass'n Moves to New Quarters

The Magnesium Association announces the removal of their offices to the Chanin Building, Rm. 307, 122 East 42nd Street, New York 17, N. Y., effective Sept. 1st.

#### Thomas Pre-plated Metal Strip Has Western Agent

The Thomas Steel Company, manufacturer of cold rolled strip steel specialties marketed under the trade name "Thomas Strip," announces the appointment of California Cold Rolled Steel Corp., Los Angeles, as western distributors and agents.

The products which California Cold Rolled Steel Corporation will handle include Thomas Strip electrocoated with nickel, copper, zinc, brass and chromium, as well as hot dipped tin and lead alloy coatings. The new chromium coated product will be known as Chrome-Coat. Additional Thomas products to be marketed are lacquer coated strip steel, annealed and tempered spring steel, alloy strip steel and uncoated precision strip. A new zinc coated, black colored strip steel has recently been developed and is now appearing on the market.

#### New Process Engineering Department at Detrex

The newly created Process Engineering Department of Detrex Corporation will be headed by George W. Pew, according to an announcement by A. O. Thalacker, vice-president and general manager.

In addition to handling engineering requirements of Detrex factories, other than product design, this department will investigate and make recommendations on operating methods and fabricating processes. It will also exercise complete quality inspection control on all manufactured items except solvent and cleaning compounds. This includes degreasing and metal parts washing machinery, drycleaning equipment, oil-extraction plants, and food processing equipment.

# TODAY'S BEST BUY

## for Setting Up POLISHING WHEELS AND BELTS

**GRIPMASTER**  
PATENTED  
POLISHING WHEEL CEMENT

LEADING PLANTS REPORT:

**GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!**

- Now!** Longer Wheel Head Life! Thanks to Gripmaster's special high-heat resisting ingredient!
- Now!** Fewer Stops for Wheel Changes! Gripmaster locks in grains of emery "vise tight!"
- Now!** Inventories Simplified! One grade grips all grains—300 to 20. No special sizer needed!
- Now!** Better Finishes! Greater flexibility gives more and finer "breaks" when wheel is "cracked!"
- Now!** Goodbye to S. O. I! There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"



GRIPMASTER DIVISION  
NELSON CHEMICALS CORPORATION  
12345 Schaefer Hwy, Detroit 27, Mich., U.S.A.

IN CANADA:  
H. C. Nelson Chemicals, Ltd.  
Windsor, Ontario

- ☐ Send us a generous FREE SAMPLE of Gripmaster.
- ☐ Send us data on how to boost polishing production.
- ☐ Have a representative call to demonstrate.

MF949

COMPANY \_\_\_\_\_  
ATTENTION \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

## ELECTROPOLISHING IN JAPAN

By Sakae Tajima, D.Sc.

Tokyo Metropolitan Univ., Tokyo, Japan

### Editor's Note

This is the first communication to come directly to our attention from Japan in nearly ten years, and indicates the type of research and development being carried on there in the field of metal finishing. Dr. Tajima is one of Japan's foremost electrochemists, and is presently secretary of the Electrochemical Society of Japan.

In Japan as well as elsewhere, electropolishing is attracting much attention in the field of science and industry. As we were isolated from the

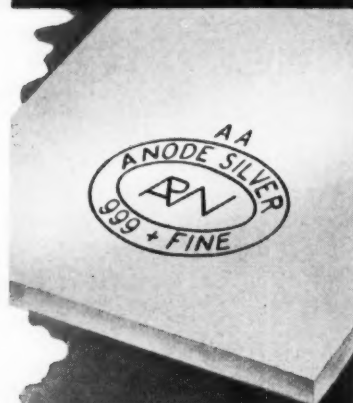
world since 1942, electropolishing had to be developed independently, and owing to this fact, it will be somewhat interesting to briefly describe the status of electropolishing in Japan.

Commercial applications of electropolishing were developed during the war, for example, for fountain-pen finishing, pivots of electrical instruments, parts of magnetrons e.g. plates, filaments, sleeves and stems.

As a post-war finishing method electropolishing has found wide application and is being diligently studied in many laboratories and factories. The electropolishing methods for steels, stainless steels, aluminum and its alloys, nickel, copper and its alloys, tungsten, molybdenum, silver, etc. are commercially applied. Articles pro-



## "Activated" SILVER ANODES



WRITE US FOR  
FULL INFORMATION  
AND CURRENT  
QUOTATIONS

## SAVE 4 WAYS

Users say our "AA" anodes produce a larger amount of finished work due to:

- ① The large reduction in the amount of rejects of finished goods. Less stripping.
- ② Full use of the anode (no lace or herring bone formation). Less scrap.
- ③ Uniform dissolution of the anode, thereby maintaining a nearly constant anode area, facilitating computation of effective surface (of particular interest to larger plants).
- ④ Cleaner, brighter finished work.

### IMPORTANT

Every anode lot is laboratory tested and guaranteed to give complete satisfaction under normal conditions.

WE RECOMMEND APW SILVER CYANIDE  
100 and 1000 ounce drums.

**THE AMERICAN PLATINUM WORKS**  
231 NEW JERSEY R.R. AVE., NEWARK 5, N. J.

## PLATING AND POLISHING EQUIPMENT AND SUPPLIES

CLEAN-RITE ALL PURPOSE CLEANERS  
PLATING RACKS • BUFFS • COMPOSITIONS

• • •

Let us help you solve your Finishing Problems.  
Costly rejects can be reduced and the Finish improved.  
Take advantage of our Practical Experience.

**JACOB HAY COMPANY**  
Centralized Distributors

4014 WEST PARKER AVE.

CHICAGO 39, ILL.

TEL. CAPITOL 7-8800

processed are turbine blades, sewing-machine and bicycle parts, needles, electrical instruments (pivots, contact points, etc.), tableware (spoons, forks, etc.), medical and dental instruments, decorative accessories, reflectors, and preliminary and final finishing of electropolished coatings (brass, Ni, Ag, steels).

One firm engaged exclusively in electropolishing is in commercial activity (Nikko Metallo-chemical Co. Ltd., Yokosuka).

On the theory of electropolishing, Japan has made some worthwhile contributions. They are briefly summarized in the following items:

(1) The exact proof of the existence of the passivated film (e.g. oxide film) on the electropolishing surfaces (by potentiometric method, electron-diffraction<sup>2, 3, 5</sup>).

(2) Relations between metals and then suitable electrolytes are assumed and verified<sup>11, 13</sup>. Acidic electrolytes for basic metals, alkaline electrolytes for acidic metals (W), acidic and alkaline electrolytes for amphoteric metals (Al, Zn, etc.), cyanide solutions for complex-forming metals<sup>11, 12</sup>.

(3) Applications of alternating current to Fe, Steel<sup>9, 13</sup>, Ni, etc. and the mechanism studied by oscillographic techniques.

(4) Contribution to *Jacquet's* theory of soluble liquid film and the addition of oxalic acid to the phosphoric bath for iron and steel<sup>9, 13</sup>.

(5) The effect of the bath, diminution of the current density by separating the electrodes, for example, by perforated diaphragms, U-tubes, or by setting the cathode and anode areas.

(6) Relations between the current density and the area, shape and form of the anode<sup>6, 13, 14</sup>.

(7) Effect of organic additions<sup>7, 8, 12, 14</sup>.

(8) Relations between polishing action and the periodic, passive phenomena of the anode<sup>12, 13, 14</sup>.

(9) Measurement of the electrical contact resistance of the electropolished surfaces.

About twenty methods are patented and now on file at the Japanese Patent Office.

### Japanese Literature on Electropolishing

1. S. H. and M. Yamamoto: J. Inst. Elec. Engrs., Japan 56, 123-4, (1945)
2. N. Takahashi: J. App. Phys., Japan 12, 209 (1943)
3. N. Takahashi: J. App. Phys., Japan 17, 212 (1948)

4. S. Tajima: J. Electrochem. Soc., Japan 12, 221 (1944)
5. S. Tajima: J. Electrochem. Soc., Japan 14, 4 (1946)
6. S. Tajima: J. Electrochem. Soc., Japan 14, 37 (1946)
7. S. Tajima: J. Electrochem. Soc., Japan 14, 41 (1946)
8. S. Tajima: J. Electrochem. Soc., Japan 14, 129 (1946)
9. S. Tajima: J. Electrochem. Soc., Japan 14, 164 (1946)
10. S. Tajima: J. Electrochem. Soc., Japan 15, 17 (1947)
11. S. Tajima: J. Electrochem. Soc., Japan 15, 19 (1947)
12. S. Tajima: J. Electrochem. Soc., Japan 16, 29 (1948)
13. S. Tajima: (review) J. Electrochem. Soc., Japan 13, 64-85 (1945)
14. S. Tajima: Metals 18, 4, 5, 6, (1948)
15. S. Tajima: 12 technical descriptions on Metals, vol. 16-18 (1946-48)

## PATENTS

(Continued from page 78)

### Producing High-Purity Electrolytic Zinc

U. S. Patent 2,471,965. S. P. Lowe, G. W. Long, G. H. Kent, and K. W. Downes, assignors to Hudson Bay Mining & Smelting Co.

The method of electrolytically producing zinc of high purity from a zinc sulphate electrolyte containing at least one of the impurities lead, copper, cadmium and iron, which comprises adjusting the pH of the electrolyte to a state of substantial equilibrium neutrality, said neutrality being a pH of 5.1 to 5.5, adding cresylic acid and pine oil to the electrolyte in amounts sufficient to reduce the amount of said impurities and not more than will dissolve in the electrolyte, and passing electric current from an impure zinc anode to a cathode through said electrolyte containing said cresylic acid and pine oil to deposit said zinc of high purity.

### Automatic Plating Conveyor

U. S. Patent 2,461,113. Arthur H. Friedman, assignor to Hanson-Van Winkle-Munning Co.

In a fluid treating machine, mechanism for moving workpieces comprising: a horizontally extending arm, means for moving said arm in a horizontal direction and for halting movement of said arm in said horizontal direction, means for moving said arm in a vertical direction to a fluid treating work station, a workpiece supporting member, means for pivotally sup-

## "AJA-DIP" for those Cleaning Economies you want!



**Magnus Aja-Dip Cleaning Machines Offer You Better Cleaning, Greater Flexibility and Speed — Speed — Speed!**

**B**ecause they are so fast in their cleaning action, they are ready for another load when ordinary machines are just starting to clean. When they are used with the right Magnus Cleaner, they give you a much better cleaning job than still tanks, spray-type machines or any other cleaning method.

The reason is their unique operating principle, through which the work is moved up and down IN the cleaning solution many times a minute. This dynamic mechanical cleaning action supplements the work of the solution.

### Proof?

#### STEEL PARTS

— toys and tools, replacing vapor degreasing. Output ten times that of former method at one-half the cost.

#### SURGICAL INSTRUMENTS

— replacing still tank soak in solvent plus hand brushing. Output many times that of former method. Over-all costs reduced 25%. Rejects on plating operation virtually eliminated. Workers freed for productive work.

#### AIRPLANE PARTS

— propeller hub and governor assemblies. Former method, still tank soak and hand work. Output tripled. Costs reduced by 55%, while damage to delicate parts has been eliminated.

#### MAGNETOS

— two complete magnetos an hour could be cleaned by former method. With Aja-Dip, thirty better cleaned units an hour are handled. One man and the Aja-Dip produce what four men did by hand methods.

There's an Aja-Dip Machine to meet your capacity needs. **INVESTIGATE!**

**MAGNUS CHEMICAL COMPANY** • 11 South Ave., Garwood, N. J.  
In Canada—Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que.  
Service representatives in principal cities



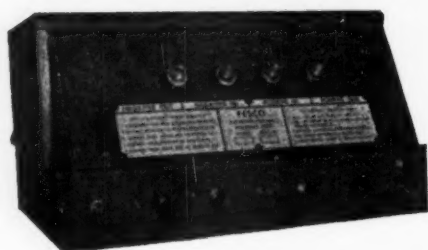
**IN METAL CLEANING IT'S**  
**MAGNUS**  
**CLEANERS • EQUIPMENT • METHODS**



"If it's metal finishing equipment or supplies, we have it"

## PESCO PERIODIC REVERSER

(electroplating interrupter)



**Speed Up the Rate of Plating—Produce Heavier Deposits—Reduce Porosity—Smoother Surfaces—Brighter Finishes—Less Buffing!!**

We carry a complete line of equipment and supplies for the metal finishing industry. Plating, baking, polishing, spraying and tumbling equipment our specialty.

We manufacture polishing machines, tanks, rheostats, tumblers, agitators, reversers, etc.

**Inquire about our rebuilt and guaranteed equipment.**

Compressors, rectifiers, generators, compounds, buffs, brushes, anodes, etc., always in stock.

PLEASE WRITE FOR ADDITIONAL INFORMATION

**PESCO PLATING EQUIPMENT CORP.**  
182 Grand St., New York 13, N. Y.  
Canal 6-3010-1-2

### RECEPTION and DINNER

*Honoring*

**New A.E.S. President—Arthur W. Logozzo**

**SATURDAY OCTOBER 15, 1949 1 p.m.**

**City Club—Trumbull and Allyn Sts.—Hartford, Conn.**

**Dinner 1:30 p.m.—Guest Speakers**

Illustrated talk "Plating in Motion and the Evaluation of Electrodeposits" by WM. PHILLIPS, Chief of Electroplating Research, General Motors Corp.

*The Hartford Branch extends a cordial invitation to all those interested to attend this tribute to Connecticut's own "Artie" Logozzo, the second New Englander ever to be elected President of the American Electroplaters Society.*

porting said workpiece supporting member on said arm, means for oscillating said workpiece supporting member about said pivot in a plane which is transverse to the movement of said arm in said horizontal direction, said oscillating movement occurring only after said workpiece supporting member has been moved vertically to its work station, said last-named means including a lever system, said lever system being mounted on said arm and having a downwardly extending free end, an upwardly extending track engageable by said free end when said arm and the workpiece supporting member have been moved to their work station, and means for oscillating said track.

### Phosphating Treatment for Steel

*U. S. Patent 2,471,907. Eugene Snyder, assignor to American Chemical Paint Co.*

In the art of coating ferrous metal to increase its corrosion resistance the method which includes the step of treating the surface with a bath the essential coating-producing ingredients of which consist of an aqueous solution of phosphate from the class which consists of alkali metals and ammonium, said solution also containing from about 0.0005% to 0.05% by weight of the total treating solution of soluble chlorite calculated as  $\text{NaClO}_2$  and the pH of said solution being from approximately 4.5 to approximately 6.5.

### Preparing Steel Surfaces for Phosphating

*U. S. Patent 2,471,908. Eugene Snyder, assignor to American Chemical Paint Co.*

In the art of coating ferrous metal the method which includes the step of treating the surface with a composition the essential coating-producing ingredients of which consist of an aqueous solution of phosphate from the class which consists of alkali metals and ammonium, said solution also containing a quantity of soluble peroxide compound sufficient to give an available oxygen per cent by weight of the total treating solution of from about 0.008% to about 0.00016% and the pH of said solution being from approximately 4.5 to 6.

### Reclaiming Selenium Cells

U. S. Patent 2,471,898. David W. Rau, assignor to Vickers, Inc.

A method of treating finished selenium rectifier cells, which comprises dipping the cells in an electrolyte of an organic amine, removing said cells from the electrolyte aging the dipped cells for a period of 12 to 48 hours, and electrically forming the cells.

### Immersion Copper Coatings on Steel

U. S. Patent 2,472,393. S. C. Avalone & A. W. Harris & E. J. Whiting, assignors to Amer. Steel & Wire Co.

The method of chemically depositing fine grain copper coating on ferrous metal as lubricant for cold working the metal comprising immersing the metal in an aqueous bath consisting by weight of 0.40 to 10% cuprous chloride, 2 to 12% hydrochloric acid, 0.4 to 20% of an agent for enhancing solubility of cuprous chloride selected from the group consisting of ammonium chloride, sodium chloride, calcium chloride and potassium chloride, 0.01 to 0.20% polyethylene glycol of molecular weight 3500 to 4500, and the remainder water, the bath being maintained at a temperature in the range 70° to 195° F. and in the presence of a reducing agent for preventing oxidation of cuprous chloride, the reducing agent being of the group consisting of metallic copper, metallic tin and stannous chloride.

### Periodic Reverse Plating of Nickel and Cobalt

U. S. Patent 2,470,775. G. W. Jernstedt and M. Ceresa, assignors to Westinghouse Electric Corp.

In the process of electroplating nickel, cobalt and nickel-cobalt alloys on a member from an electroplating electrolyte thereof, the steps comprising apply to the member, while in contact with the electrolyte, a periodically reversed electrical current consisting of successive cycles, of which each cycle renders the member cathodic for a period of time of less than two seconds to electrodeposit an increment of metal on the member and then renders the member anodic for a period of time from 1/2 to 1/25 of the cathodic time period to deplate the metal, the anodic period being not less than

# IRIDITE

keeps zinc plate

## STAIN FREE, SPARKLING BRIGHT

on



Because it economically gives lasting, chrome-like brightness to zinc or cadmium plate, Iridite Bright is the final finish on hardware for The Cleveland Welding Company's famous Roadmaster Bicycle. Shop-wise, Iridite Bright offers many advantages: a simple chemical dip, ease and speed of operation, non-electrolytic, requires only usual plating shop equipment and operators. And you get uniform consistent results from manual or automatic handling.

Other Iridites provide amazing corrosion resistant finishes and excellent paint adherence for all zinc and cadmium surfaces—die-cast, galvanized or plated.

Does this give you any ideas for your own products? Then write today for descriptive folder and samples. Or, better still, send your product samples for free processing.

### ALLIED RESEARCH PRODUCTS, INC.

4004 EAST MONUMENT STREET  
BALTIMORE 5, MD.

West Coast Licensee—L. H. Butcher Co., Los Angeles 23, California

### IRIDITE COATINGS ARE USED ON

Washing Machine Parts

Radio Equipment

Kitchen Utensils

Aircraft Parts

Lock Hardware

Office Machines

Window Frames

Vending Machines

Wire Cloth

Tools

Lamp Fixtures

Fuel Pumps  
Carburetors

Auto Hardware

Zinc Coated Sheet

Hinges, Screws, Bolts

Camera Parts

Plumbing Fixtures

Wall Panels

Refrigerator Parts

Wire Products

Instrument Parts

Electrical Equipment

1/500 of a second, the current density during the anodic period being substantially equal to the current density applied during the cathodic period.

### Pickling Stainless Steels

U. S. Patent 2,474,526. J. J. Healy, Jr., M. H. Taylor, & F. A. Abbiati, assignors to Monsanto Chemical Co.

An aqueous acid reacting non-electrolytic pickling bath for stainless steels consisting essentially of water and active pickling agents consisting of a non-oxidizing mineral acid and ferric fluoride, said mineral acid being present in the bath in an amount varying between 0.7 and 25% and said fluoride being present in an amount varying between 0.5 and 20%, said bath being substantially free of nitric acid.

### Letter to the Editor

Metal Finishing

11 W. 42nd St.

New York, N. Y.

Dear Editor:

In the June issue of METAL FINISHING, you published a very interesting article by Mr. Joseph Haas on "Refinishing Hollow Ware."

The article was a clear, brief and inclusive summary of the usual operating procedure in this kind of work.

One matter caught my particular attention, and that was toward the end of the article under the heading of "Polishing Department," which dealt largely with the matter of sand polishing. Mr. Haas made two clear distinc-

tions with regard to a sanding operation—sand bobbing and sand buffing. The former is done for the removal of deep scratches and dents and in this operation walrus and bullneck wheels, when available, are generally used.

For sand buffing, which is done on softer wheels or buffs, Mr. Haas suggested charging the buff, which is sometimes sheepskin and more often muslin cloth, with ordinary brown laundry soap which provides a better

base bond for the powdered pumice stone and oil mix.

For a great many years, the silverware trade has used a special treated buff known as Printers Ink Buff. These are made of unbleached muslin which has been impregnated with printing ink. This coating toughens and strengthens the fibre of the cloth giving longer life. Also, when the buff becomes warm from frictional heat, it presents a tacky surface which gives better adherence to the abrasive and eliminates the necessity of using laundry soap as Mr. Haas suggested.

Printers Ink Buffs are available in all sizes from small bobbys of 1" diameter up to large size diameters and from 1/4" thick to 3" face with all types of machine or hand sewing.

We have had this matter up with Mr. Haas and he has suggested that we call this to your attention.

Sincerely yours,

Lloyd S. Burns.

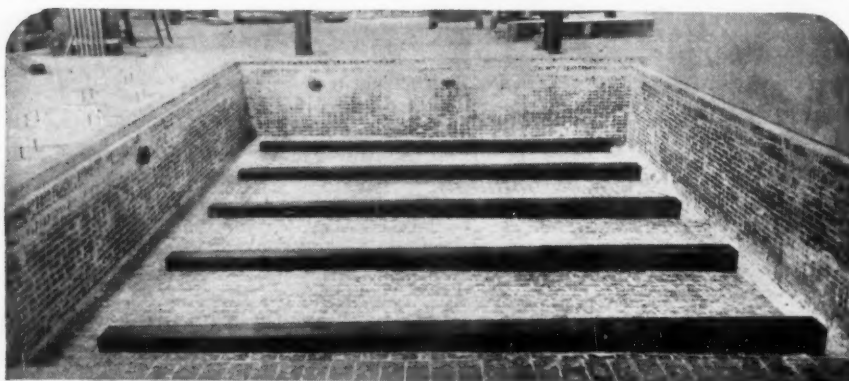


Complete Engineering Service for your Plating and Polishing Room

Office and Warehouse

352 MULBERRY STREET

NEWARK 2, N. J.



## This Pickling Tank Foundation Is Another Acid Proof Installation *by Ceilcote*

Our quarter century of experience is your guarantee of performance. When you plan construction of new pickling tanks, neutralizing tanks, floors, process tanks or fume ducts write for recommendations concerning your specific operating conditions. Representatives in most principal cities.

Ceilcote Products include acid and alkali proof—  
• Linings • Membranes • Bonding Cements • Brick •  
Protective coatings

★ FROM DESIGN TO  
★ INSTALLATION OF  
★ CORROSION-PROOF  
★ EQUIPMENT YOU  
★ CAN RELY ON

★ CEILCOTE



## Corrosion Proof

MATERIALS • CONSTRUCTION • SUPERVISION

The CEILCOTE Company ROCKEFELLER BUILDING • CLEVELAND 13, OHIO

## NEW BOOK

### Elementary Metallurgy and Metallography

By Arthur M. Shrager. The Macmillan Co., 60 Fifth Ave., New York, N. Y. Price \$4.75.

In this book, which is written primarily for the person without engineering training, the author explains the fundamental principles of the science of modern metallurgy, and discusses the characteristics and properties of the commercial metals and alloys as they affect their fabrication and use. The book is unusually well illustrated, making it easier for the non-technical person to obtain an intelligent understanding of this important practical science. Die casting and powder metallurgy are two of the subjects covered which are ordinarily not included in most elementary books on the subject. The 20 page Glossary of terms commonly used in the metal working industry is also a valuable addition. The book should fill a need in the present trend towards books on highly technical subjects that are written in a more popular language for the non-technically trained person.

W. A. R.



## Manufacturers' Literature

### Polishing and Buffing Machinery

*Hammond Machinery Builders, Inc.,  
Dept. MF, 1639 Douglas Avenue, Kalamazoo, Mich.*

This firm has just announced release of their informative catalog covering polishing, buffing, grinding and deburring machinery. The New Catalog No. 60 describes new and improved polishing lathes, backstands for abrasive belts, to be used with polishing lathes, improved OD cylindrical finishing machines for tubes, bars and cylindrical stock; contour finishing machines for odd or irregular shapes, and the new and complete line of 10 Junior Automatics for use in conjunction with polishing lathes or abrasive belt machines. The new Catalog illustrates a very complete line of polishing, buffing and deburring equipment.

### Bright Zinc Plating In Barrels

*Hanson-Van Winkle-Munning Co.,  
Dept. MF, Matawan, N. J.*

Technical instructions on the BBZ-200 Process for bright zinc plating in barrels are covered in a new manual issued by this firm. The features claimed for this process are:

1. High brightness.
2. Bright dipping not essential.
3. Extremely low brightener concentration and consumption.
4. Low operating cost.
5. Process designed for high current densities.
6. Non-critical operation and control.
7. Special equipment not required.
8. Excellent covering power.
9. Readily accept conversion coatings; can be soldered with relative ease.
10. Uses non-sludging ZA alloy anodes.

The manual describes in detail the preparation of the solution, the conversion of existing solutions, the effects of constituents, solution operation and control, maintenance, the effects of impurities, voltage, temperature, anodes, thickness of zinc deposit, rinsing, bright dipping and drying, equipment requirements, and lastly, the problem of plating gray iron and malleable castings in barrels.



**PERMAG**  
MAGNUSON PRODUCTS CORPORATION  
50 COURT STREET  
BROOKLYN 2, NEW YORK  
INDUSTRIAL CLEANING COMPOUNDS

**- here's  
the TICKET  
that brings you  
BETTER  
Metal Cleaning  
SERVICE**

PERMAG—the fast action, efficient, economical compounds are ready to serve you in every metal cleaning requirement. NOW is the time to put PERMAG on the job at your plant. If you have a tough cleaning problem, let us help you with it.

*Write us at once for the name of our nearest representative to you. An interview will be helpful. No obligation on your part.*

**MAGNUSON PRODUCTS CORPORATION**  
*Manufacturers of Specialized Scientific Cleaning Compounds*

*Mfrs. Specialized Cleaning Compounds for Industry*  
**Main Office, 50 Court St., BROOKLYN 2, N. Y.**  
Nationally Represented      Warehouses in chief cities

**In CANADA: Canadian PERMAG Products Ltd., Montreal, Que.**

### Blast Cleaning Machines

*American Wheelabrator and Equipment Corp., Dept. MF, 555 S. Byrkit Street, Mishawaka, Ind.*

Two batch-type blast cleaning machines in the line of Wheelabrator Tumblasts have been redesigned to incorporate new features and improvements.

Bulletin No. 114-A features the new 36" x 42" Wheelabrator Tumbblast (11½ cu. ft. capacity) and Bulletin No. 124-A catalogs the new 48" x 42" Wheelabrator Tumbblast (17½ cu. ft. capacity). Both bulletins are complete with photographs, drawings, and data about features, construction, and specifications.

A copy of either or both of these

bulletins may be obtained by writing to the manufacturer.

### Parts Drying Machine

*Randall Mfg. Co., Dept. MF, 801 Edgewater Road, New York 59, N. Y.*

This firm has just issued a new bulletin describing their Spotless Parts Dryer, which is used to replace the old sawdust method of drying finished parts with a spotless finish. A completely enclosed and integrated unit, this spot dryer is available in many models for any method of heating. Temperature of the air blast is controlled by thermostatic means, and the average drying time for a batch of parts is approximately one minute, according to the manufacturer. Cop-

ies of this bulletin are available upon request.

### Analyzing Plating Solutions

*Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N.J.*

A new book has been issued by this firm entitled "Simple Methods for Analyzing Plating Solutions." This is a long-awaited revision of what has become a standard textbook for the electroplating industry, especially useful to those who, in doing their own solution analysis, wish to avoid the complications of the more involved methods. The book describes the principles involved in analysis, the use of apparatus, the methods of sampling a solution and the methods of analyzing for all of the important constituents in solutions for plating brass, cadmium, chromium, copper (cyanide and sulphate), gold (cyanide), black nickel, white nickel, H-VW-M bright cobalt-nickel, silver (cyanide), tin (alkaline), zinc (cyanide, Mazic and sulphate). An appendix covers the determination

of Rochelle Salt in a cyanide copper plating solution.

The book also includes descriptions of analytical equipment and solutions, and a number of very useful tables such as atomic weights, concentrations of acids, conversion factors, electrochemical data, electromotive series, galvanic series, metal salt solubilities in cyanides, percentage compositions of plating salts, reaction of acids and alkalis on metals, a table of conversion factors and a temperature conversion table.

A copy of this new book will be sent on request.

### Wire Cloth Specialties

*Cambridge Wire Cloth Co., Dept. MF, Cambridge, Maryland.*

A new bulletin just issued by this firm illustrates some of the many wire products manufactured for the metal cleaning and finishing industry. Included are wire dipping and pickling baskets, rotary wire barrels, racks, heat-treating trays, and many others. Copies of this Bulletin No. 96 are available on request.

### Industrial Safety Clothing and Equipment

*E. D. Bullard Company, 275 Eighth Street, Dept. MF, San Francisco 3, California.*

The 1949-50 issue of "Everything In Safety," E. D. Bullard Company's complete catalog of personal protective equipment and industrial safety devices has just been issued. The catalog is divided into five sections, First Aid; Respiratory Protection; Eye Protection; Hats, Belts and Clothing; Miscellaneous Safety Equipment.

Requests for catalog should be made on company letter head.

### Brushes for Electroplating and Metal Finishing

*Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.*

Bulletin BR-104 entitled "H-VW-M Brushes" has been issued by the above firm. This Bulletin lists and describes in detail the full line of brushes for the electroplating and metal finishing in-

**FASTER CUTTING**

**LONGER WEAR**

**AIR-COOLED**

**WILL NOT BURN**



**185,000** PIECES PER WHEEL  
HAVE BEEN BUFFED WITH  
**CHURCHILL FINGER-BUFFS\***

DESCRIPTIVE LITERATURE AND SAMPLES ON REQUEST

SOLE MFRS.

**GEO. R. CHURCHILL CO., INC.**  
NO. QUINCY 71, MASS.

\* TRADE MARK—PATENTS NOS. 2146284, 2350216. OTHERS PENDING.

**Are You Satisfied  
With Your Finish?**

Try

**HARRISON'S**

**4A**

**COMPOUNDS**

for

**Aluminum, Brass, Copper, Stainless  
Steel, Carbon Steel, etc.**

TRY OUR NEW GREASE STICK; ALSO  
OUR NEW WATER SOLUBLE COMPOUNDS.

*Our technical Representative will be pleased to  
help you with your problems.*

**HARRISON & COMPANY, INC.**  
HAVERHILL, MASSACHUSETTS

dustry, including StapLbond Tampico brushes and StapLbond wire brushes (steel, brass, nickel silver or stainless steel); circular wire scratch brushes (brass, steel, nickel silver or stainless steel) with large or small hub; wire-drawn circular Tampico brushes; wire-drawn circular nylon brushes; satin finish hanger brushes with steel wire tufts and bronze hubs; goblet brushes; platers' brushes with curved handle, straight handle and shoe handle, of Tampico, and of cotton; circular cotton wick brushes; glue brushes, saw-dust brushes; spiral wire ring brushes; end brushes; watch case brushes and a variety of special brushes.

The feature of this bulletin is that it emphasizes the most suitable use for each brush, and it is well illustrated. It also includes technical data such as arbor holes and average speeds for brush wheels of different sizes and types.

#### Karbate Pipe and Fittings Manual

National Carbon Co., Inc., Dept. MF, 30 East 42nd Street, New York 17, N. Y.

This firm announces the publication of an Installation Manual for use in connection with its present Karbate Brand Pipe and Fittings Booklet, Catalog Section M-8800B. The manual gives detailed information on the installation of Karbate pipe, fittings and connections and also on the cements that are used to bond these products. It shows the prospective user how easy it is to fit and assemble Karbate pipe and fittings.

A copy of Catalog Section M-8801, the installation manual and its companion booklet, Catalog Section M-8800B, may be obtained by writing to the above address.

#### 48" Continuous Wheelabrator Tumblast

American Wheelabrator and Equipment Corp., Dept. MF, 555 S. Byrkit Street, Misawaka, Ind.

A catalog describing the 48" Continuous Wheelabrator Tumblast, an airless abrasive blast cleaning machine, has recently been issued by this firm.

This is the newest model of American's line of continuous, automatic Wheelabrator Tumblasts. By utilizing the unique combination of tumbling and longitudinal travel of the work,

# You Are Paying

FOR A ...

## Hammond JUNIOR AUTOMATIC

### WHY NOT USE IT!



Model E2SF with  
Hammond Polishing Lathe

**Finishing costs are high and will go higher** as buyers insist on better finishes — they're doing it. There is only one answer to this situation — **FASTER AND BETTER FINISHING EQUIPMENT.**

Polishing by hand is hard and slow work. With a Hammond Junior Automatic the operator merely loads and unloads, resulting in high production and uniform finishes throughout the day.

Hammond Junior Automatics soon pay for themselves. If you are interested in reducing finishing costs—send one finished and several rough samples for complete engineering report — No Obligation.

*Hammond Machinery Builders* INC

1601 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

the Continuous Tumblast offers thorough cleaning and uninterrupted efficiency, it is claimed. No time is lost for starting, stopping, loading and unloading, as in the conventional type batch mill, since parts are fed into and discharged from the machine in a continuous flow.

Work to be cleaned is carried through the blast barrel on an endless apron type conveyor which constantly tumbles and cascades the pieces, thereby completely exposing all surfaces of every piece to the full effect of the abrasive blast from the overhead Wheelabrator unit, it is claimed.

The rate at which the work progresses through the cleaning chamber is regulated by tilting the mill to the

proper angle by means of jack screws. Since the speed of tumbling and the flow rate of work through the mill can be adjusted to suit the work, the speed of production and the quality of cleaning can be accurately controlled.

The catalog is complete with pictures, drawings and phantom views of operating parts of the machine. A copy of this catalog may be obtained by writing directly to the manufacturer.

#### Hard Chrome Plating

The Cro-Plate Co., Inc., Dept. MF, 3343-47 Main St., Hartford 5, Conn.

A bulletin just published by this firm describes the precision chrome plating operations conducted by them on a wide variety of industrial prod-



ucts, including the plating of standard cutting tools, plating of new or worn gages, and direct chrome plating on aluminum and zinc. The bulletin also describes the production facilities of their plant and the research and development services available. Copies of this bulletin are available on request.

### Repairing Rubber-Lined Equipment

*Carboline Co., Dept. MF, 7603 Forsythe Blvd., St. Louis 5, Mo.*

Bulletin C-3, "How to Resurface and Repair Rubber Lined and Hard Rubber Equipment for Corrosive Service" is the title of a folder issued for plant and maintenance engineers interested in reducing maintenance costs.

If rubber lining is damaged or deteriorated, a new lining can be installed by the use of various resin cements and coatings which have greater resistance to heat and corrosion than rubber itself, it is claimed. It is even possible to protect rubber from attack by solvents and it is possible in some instances to make new

parts to replace deteriorated hard rubber.

Five resins are offered for various patching, relining, resurfacing and repair work on rubber equipment. Between them, practically every rubber equipment salvaging job not requiring great flexibility can be accomplished, it is claimed. All of these resins adhere fast to rubber and can be applied to metal with the use of a primer. Materials are mixed prior to use and applied at room temperature.

The chief advantages claimed for the new resins are:

1. Resistance to temperatures up to 350° F.
2. Resistance to *solvents*, acids and alkalis.
3. Setting or solidification at room temperature.
4. Corrosion resistance superior to that of rubber.

### News from California

*Alumatone Corp., Los Angeles*, announces a chromatic brilliant copper

finish as the newest among four recent additions to its line of decorative gold-bronze finishes. The new metallic finishes are reported to include copper, pale gold, rich gold and roman gold for brush or spray application.

*California Metal Trades Association*, San Francisco, has named as new president, *Cloyd Gray*, of the W. R. Ames Co. The association functions as a sectional industry organization to foster the common problems of the metal trades and allied industries.

*Cool-Amp Co., Portland, Ore.*, announces a new method of silver plating high-amperage electrical connections on the job. In the form of a silver plating powder, Cool-Amp is reported to deposit a genuine coating of silver that will not peel off and also gives maximum conductivity for copper, brass and bronze contacts.

*Select Steel Co., Los Angeles*, has completed a new plant of 12,000 square feet floor area at 2123 West Stoner Ave., West Los Angeles, for the pro-

## IMPROVED FINISHES ..

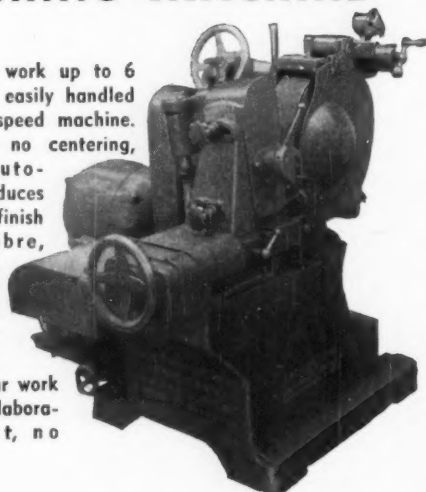
WITH THIS

## PRODUCTION TYPE 101

— CENTERLESS —

## POLISHING MACHINE —

• Cylindrical work up to 6 inch diameter easily handled on this high speed machine. No chucking, no centering, just feed automatically. Produces high quality finish on metal, fibre, plastic, and many other materials using unskilled labor. Send us samples of your work for complete laboratory report, no obligation.



WRITE TODAY  
FOR  
BULLETIN MF5

*Production*  
MACHINE COMPANY

GREENFIELD, MASSACHUSETTS, U.S.A.

# FREE

TEST PAPERS

for

TESTING

ZINC

SOLUTION

*Sulphur Products Co. Inc.*  
Greensburg 7, Pa

SOLE PRODUCERS OF

*McKeon's*

*Zinc-Brite*  
TRADE MARK REG'D.

duction of stainless steel drainboards and store fronts.

John O. Fryberg has been named manager of Sandaire Mfg. Co., Los Angeles, manufacturers of portable sandblasters.

University of California Extension Division, Los Angeles, is offering two courses of interest to engineers and those in related fields. Both courses start in mid-September.

One course, dealing with technical literature and library orientation, covers the importance of technical organizations, publications, bibliographies and reference sources, preparation of notes, abstracts and annotated reviews.

The second course deals with technical report writing, including engineering reports, organizations, preparation, presentation and organization for writing the report, style and choice of words.

The classes will be held once a week for two hours, beginning September 15, at the Los Angeles Campus of the University of California.

## Associations and Societies

### AMERICAN ELECTROPLATERS' SOCIETY

#### Chicago Branch

On July 22 the following members met for dinner and business meeting:

J. M. Andrus, Paul Glab, Clyde Kelley, H. R. Smallman, J. M. Boudreau, R. E. Harr, H. Phillis, E. F. Stack, E. A. Stack, Larry George, R. J. Hazucha, L. E. Prabel, O. J. Bedell, R. F. Ledford.

The purpose of the meeting was to inspect the facilities offered by the Western Society of Engineers and determine the advisability of adopting this location as a place for future monthly meetings of the Chicago Branch of the A.E.S. Each of the members in attendance was favorably impressed with the many facilities offered at the Western Society of Engineers building and a motion was made and passed to adopt this location as the place of future meetings. Of particular interest is the availability of a well appointed dining room and it is hoped that many of our members will

appear on the dates of our meetings at 6:30 P.M. for dinner, to be followed by our regular meeting to be held in the auditorium later in the evening.

The Chicago Branch heartily welcomes the following new members who were this month elected to membership: Wm. E. Karry, Frank Martinek, Marion Vatikun, Peter A. Koley, Kermit Wolff.

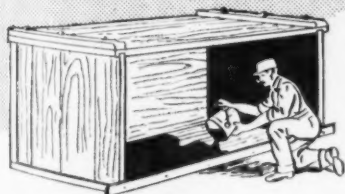
The next regular monthly meeting will be held on the second Friday of September at the Western Society of Engineers.

#### Los Angeles Branch

The annual picnic of the Los Angeles Branch of the AES was scheduled as an all-day affair Sunday, August 21, in Roosevelt Park, Los Angeles.

Feature of the morning was what was euphemistically referred to as a baseball game between the Platers and the Suppliers, with Nick Crispie serving as captain of the Platers as opposed to John Milhorn for the Suppliers. Don Bedwell was again chosen to umpire the massacre, a job in which he exhibited exceptional ingenuity in past years.

## Easy to Apply RUBBERITE TANK LINING



Just heat  
to 300° F  
and pour

Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

**Belke** MANUFACTURING CO.  
947 North Cicero Ave.  
Chicago 51, Ill.  
EVERYTHING FOR PLATING PLANTS



## PALLADIUM PLATING SOLUTION

A white non-tarnishing finish similar to platinum and rhodium plating, but costing one-fifth as much. Used extensively in electronics to protect silver and other metals from tarnishing, also used in the jewelry and optical industries, etc.

MADE ONLY BY

### LAMBROS PRECIOUS METALS CORP.

Precimet Laboratories

64 FULTON ST.

NEW YORK 7, N. Y.

#### Other products:

Rhodite—rhodium plating solution

Goldite—sodium and potassium cyanide

Silvite—silver cyanide salts

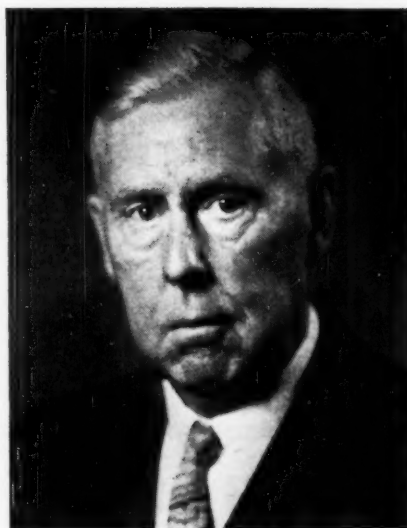
Gold, Silver, Platinum, Palladium Anodes

## AMERICAN CHEMICAL SOCIETY

### Dr. Lundell Receives Fisher Analytical Award

Dr. G. E. F. Lundell, 68, former chief of the Chemistry Division of the National Bureau of Standards, Washington, D. C., who has often been called dean of the world's analytical chemists, will receive the \$1,000 Fisher Award in Analytical Chemistry at the 116th national meeting of the American Chemical Society in Atlantic City, N. J., on September 19. Presentation of the award to Dr. Lundell, whose staff made possible the use of uranium in the atomic bomb, will be made by Professor *Linus Pauling* of the California Institute of Technology, president of the Society, at a general assembly in the Atlantic City convention hall.

Dr. Lundell, who retired from the Bureau of Standards last year, was cited particularly for his "direct contribution to applied inorganic analysis by devising new and improving old methods, and for his ability to train young men in the ways of analytical



Dr. G. E. F. Lundell

chemistry." Dr. Lundell's staff during World War II developed methods of analyzing and purifying graphite and uranium that opened the way to the use of these materials in the first atomic pile.

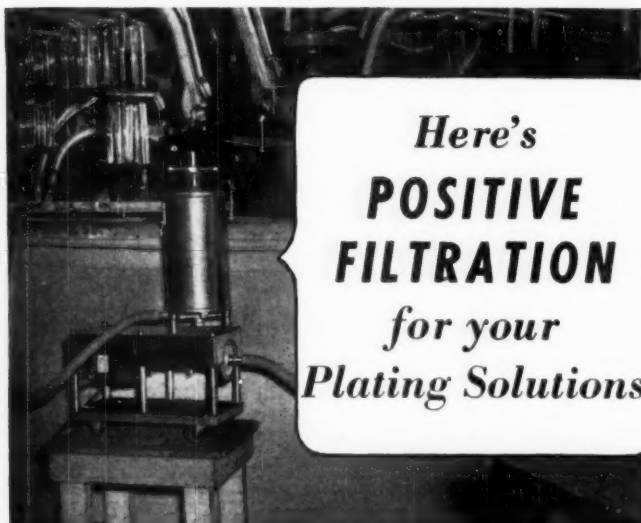
The Fisher award winner, who lives in Chevy Chase, D. C., received his Bachelor of Science degree in 1903 and his doctorate six years later from

Cornell University. He returned to Cornell in 1907 after serving as an instructor in chemistry at Northwestern University for three years. After a decade on the Cornell faculty, he joined the National Bureau of Standards, and in 1937 was appointed head of its Division of Chemistry. In 1932 Dr. Lundell, a member of the American Chemical Society since 1914, was awarded the Hillebrand Prize of the Society's Washington Section, and in 1941 Fordham University presented him with an honorary Doctor of Science degree. He was chairman of the board of editors of "*Industrial and Engineering Chemistry*" in 1935 and president of the American Society for Testing Materials in 1941. He is a member of the Washington Academy of Sciences and the American Ceramics Society.

## NATIONAL ASSOCIATION OF CORROSION ENGINEERS

### Corrosion Short Course Registration Under Way

Official applications for registration at the Short Course in Corrosion are



Here's  
**POSITIVE  
FILTRATION**  
for your  
*Plating Solutions*

YOU can put an end to costly rejects and reworking caused by impurities usually present in plating solutions. You can remove this dirt, dust and oil-sludge and keep your solutions bright and clean with an Alsop "Sealed-Disc" Filter that actually eliminates all minute particles. We'll be glad to give you all the facts—just write Alsop Engineering Corporation, 409 Bright Street, Milldale, Conn.

**ALSOP ENGINEERING CORPORATION**  
Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

## for high speed ALKALINE TIN PLATING **POTASSIUM STANNATE**

With Potassium Stannate you can speed up your electro-tin-plating . . . increase your output from present plating equipment . . . lower your costs per article plated.

Potassium Stannate has higher conductivity . . . operates at increased cathode current . . . possesses excellent throwing power . . . all of which mean speedier deposition. It is flexible in use and may be employed with little or no change (except for higher currents) in your present procedures.

Recent changes in government restrictions now permit additional uses for tin plating. Investigate Potassium Stannate and the advantages it offers for both new and existing applications. Write for further information.



**METAL & THERMIT CORPORATION**  
120 BROADWAY • NEW YORK 5, N. Y.

Producers of Potassium Stannate, Sodium Stannate, Stannous Sulphate, Stannochlor and other Tin and Antimony Chemicals



being sent out now from Central Office NACE. Persons who plan to attend the course are urged to request an official registration application at once from *A. B. Campbell*, Executive Secretary NACE, 919 Milam Building, Houston 2, Texas.

### TENTATIVE SCHEDULE SHORT COURSE IN CORROSION

University of Texas, Austin,  
September 12-16, 1949

Monday, Sept. 12

9:00-12:30 a.m. Fundamentals  
7:30-10:30 p.m. Fundamentals

Tuesday, Sept. 13

9:30-11:30 a.m. Metallurgy  
7:30-10:00 p.m. Types of corrosion

Wednesday, Sept. 14

9:00-11:30 a.m. Corrosion resistant metals  
7:30-10:00 p.m. Protective coatings

Thursday, Sept. 15

9:00-11:00 a.m. Cathodic protection  
7:30-10:00 p.m. Cathodic protection

Friday, Sept. 16

9:00-11:30 a.m. Chemical treatment  
Among the lecturers will be the following:

Metallurgy—*F. A. Prange*, Phillips Petroleum Co., Bartlesville, Oklahoma.

Corrosion-Resistant Metals—*Frank LaQue*, The International Nickel Co., Inc., New York.

Cathodic Protection—Practical Aspects—*A. W. Peabody*, Ebasco Services, Inc., Jackson, Mississippi.

Cathodic Protection—Theoretical Aspects—*Scott P. Ewing*, Carter Oil Co., Tulsa, Okla.

Types of Corrosion—*L. C. Vande Bogart*, Crane Co., Chicago, Illinois.

Fundamentals—*Dr. Norman Hackerman*, University of Texas, Austin.

Because the number that may be accommodated in the lecture hall is limited to 250, no more than that number of applications will be accepted. If more than 250 applications are received, those who apply after the course is filled will be notified and their remittances returned. Fee for the course is \$20. This fee covers all or any part of the course, and must be

paid in advance along with application for registration. For those who wish to take advantage of them, the University will make available to those taking the course up to 170 dormitory rooms on the campus.

### ELECTROCHEMICAL SOCIETY

The Ninety-Sixth Convention of The Electrochemical Society will be held at the La Salle Hotel, Chicago, Illinois, on October 12, 13, 14, and 15, 1949.

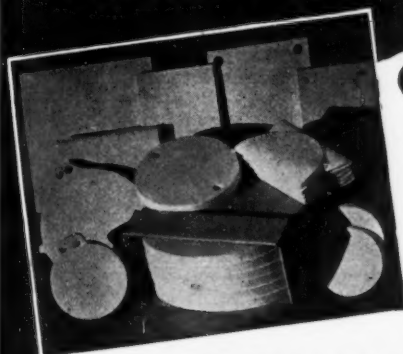
Symposia are being scheduled on Electrodeposition, Corrosion, and Organic Electrochemistry. Special round table sessions are being scheduled on Batteries and Organic Electrochemistry.

Additional information may be obtained by writing to *Henry B. Linford*, Secretary of The Electrochemical Society, 235 West 102nd Street, New York 25, N. Y.

### MASTERS ELECTROPLATING ASSOCIATION

The latest report of the Masters' Electroplating Association of New

**Unsurpassed for  
Dependable Accuracy**



*Filpaco*  
**FILTER  
PAPERS**

**FILTER CLOTHS,  
CLOTH BAGS, ASBESTOS PADS  
and other filter media**

For all types of plating solution filters . . . cut to any size and pattern . . . light and heavy weights . . . large stock maintained . . . samples furnished upon request, for experimental purposes.

Write for quotations today.

Other "FILPACO" Products:

Filters, stainless steel storage and mixing tanks, fillers, pumps, conveyors, fittings, filter paper, filter cloth, asbestos pads and filter aids.



**THE FILTER PAPER CO.**

2417 S. MICHIGAN AVENUE CHICAGO 16, ILLINOIS

**HOLLAND**  
automatic-pneumatic  
**SPRAYING MACHINE**

This new fully automatic, portable spraying machine is activated solely by air pressure. Only one operator is needed to load, and remove finished and unfinished work. Write for full information.



THREE MODELS  
AVAILABLE

4 Spindles  
8 Spindles  
12 Spindles

- GIVES AN EVEN FINISH
- SPEEDS UP PRODUCTION
- IMPROVES QUALITY OF PRODUCT

Ideal for spraying: Cans, Novelties, Compacts, Containers, Aluminumware, Electrical Appliances, Flashlights, Fans, etc.



**J. HOLLAND & SONS, INC.**

MANUFACTURERS • DEALERS

276 SOUTH NINTH ST. • BROOKLYN, N. Y.

York indicates that the rate of job shop plating operations in the New York area has hit an all time low at 41½% of capacity. This compares with the previous month's low of 43% and compares with last year's figure of 47%. The report is a compilation of the operating conditions of 65 member shops.

#### AMERICAN SOCIETY FOR TESTING MATERIALS

At the recent meeting of the ASTM in Philadelphia in June, Committee

B-8, which is the committee concerned with plating methods and plated coatings, made the following report.

The Committee presented for publication a new Tentative Recommended Practice for the Preparation of High-Carbon Steel for Electroplating. Further recommendations were that the Tentative Specifications for Electrodeposited Coatings of Zinc on Steel (A 164) and of Cadmium on Steel (A 165), and Chromate Finishes on Electrodeposited Zinc, Hot-Dipped Galvanized, and Zinc Die-Cast Surfaces (B.

201) be revised and continued as tentative. The committee also recommended that the following two tentatives be approved for adoption as standard without revision: Recommended Practices for Chromium Plating on Steel for Engineering Use (B 177-45T) and for Preparation of Low-Carbon Steel for Electroplating (B 183-43 T.)

Appended to Committee B-8's report was the report of Subcommittee II on exposure tests of copper-nickel-chromium deposits on high-carbon steel and electrodeposited lead coatings on

#### INDIAN BRAND TURKISH EMERY

This old time famous brand of emery is now in stock. Many have been waiting for it. Also available are POLISHING ABRASIVE—best for finest finishing and AMERICAN EMERY—most economical.

**HAMILTON**  
EMERY & CORUNDUM COMPANY  
Chester Mass.

#### GRANIUM A Precious metal complex salt for Silver & Gold Plating Used as an additive Harder Plate Tarnish Resistant Cyanide & Anodes

Write for booklet.

**GRANIUM PRODUCTS**  
4427 Ledge Avenue  
North Hollywood, Calif.  
Chemical Engineers since 1905

#### SOMMERS BROS. MFG. CO. MFRS. OF "BEACON"

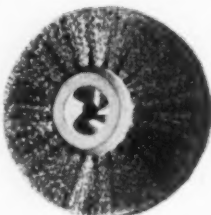
Plating and Polishing Supplies and Equipment—Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buff, Polishing and Felt Wheels.

WRITE FOR PRICES  
**3439 NO. BROADWAY**  
**ST. LOUIS 7, MO.**

#### DIXRIP FINE WIRE SCRATCH BRUSHES

- Hand Made
- Wood Hub
- Lead Centers

Made in diameters from 2½" to 8" of brass, steel or nickel silver wire in sizes .0025-.006.



Dixrip Brushes are universally used by Silversmiths, Jewelers, Watchmakers, Platers, Metal Finishers and Dental Supply Mfgs.

ASK FOR DIXRIP BRUSHES AT YOUR SUPPLY HOUSE  
OR WRITE US FOR CATALOGUE AND PRICE LIST.  
**DIXON & RIPPEL, INC. KINGSTON, N. Y.**  
Established 1856

#### "JUST WHAT THE DOCTOR ORDERED" That's what PLATERS say about\* "ELECTROPLATING KNOW HOW"

A new correspondence course in practical electroplating; written and personally conducted by Joseph B. Kushner, Metal Finishing Engineer.

Write today for free particulars

**JOSEPH B. KUSHNER Ch. E.**  
Stroudsburg 55, Pa.

\* John Fedor, Plating foreman, Willowick, Ohio

#### **SPEED-UP** your nickel stripping bath by adding **STRIPODE**

Cuts acid consumption . . .  
protects base metal . . . reduces  
pitting and roughening . . .  
minimizes need for buffing and  
coloring.

WRITE FOR FULL  
INFORMATION

**The CHEMICAL  
CORPORATION**  
54 Waltham Ave.  
Springfield, Mass.

#### DOMESTIC "VIENNA" LIME **ROCKWELL BRAND** ABRASIVE FOR USE IN COMPOSITIONS AND STEEL POLISHING

Inquiries—Domestic and Foreign—Solicited

#### **ROCKWELL LIME COMPANY**

QUARRIES  
MANITOWOC  
WISCONSIN

OFFICES  
228 NO. LA SALLE ST.  
CHICAGO 1, ILL.

steel. Sub-committee V on Supplementary Treatments for Metallic Coatings, in addition to the five sections actively engaged in studying various phases of chromate and phosphate coat-

ings on zinc and cadmium, has organized a sixth section to study and suggest testing methods for the evaluation of supplementary organic finishes on electrodeposited metallic surfaces.

a special program for the ladies attending have been arranged. Further details may be obtained from the *Instrument Society of America*, 921 Ridge Ave., Pittsburgh 12, Pa.



**High Output  
Selenium Rectifiers**

- International R.C. selenium rectifiers are engineered to meet individual requirements. Wide range of voltages and current ratings available. Samples supplied promptly.

**International Rectifier Corporation**  
68th & Victoria Ave., Los Angeles 43

## BUYERS

of any **QUANTITY**  
of the following **SCRAP**

- Ni—Anodes
- Ni—Peelings . . . Strippings . . .  
Nodules . . . Trees
- Cr—Strippings . . . Nodules . . .  
Trees
- Ni—Deposited on iron-hooks . . .  
Racks . . . Hangers
- Tin—Plating Residues
- Cadmium—Trees . . . Strippings  
. . . Nodules . . . Trees . . .  
Residues
- Molybdenum—Tungsten
- Gold—Silver
- Platinum—Scrap . . . Residues  
. . . Strippings



Write indicating grade and  
quantity available

**METALLURGICAL PRODUCTS CO.**

Established 1909

35th & Moore Sts., Phila. 45, Pa.

## Pacific Area Meeting

The ASTM will hold its First Pacific Area National Meeting in San Francisco the week of October 19, 1949. Over 70 technical papers will be presented, in addition to which there will be various Committee meetings. Headquarters will be the Hotel Fairmont.

Of special interest to metalworking and finishing men will be the various technical sessions devoted to *Plasticity and Fatigue of Metals*, and the two sessions devoted to *Aircraft Paint Finishes and Testing of Paints*.

Many leading authorities will appear on the program. Although the ASTM has had several District Meetings in the Los Angeles-San Francisco Area, this will be the first National Meeting held in that section of the country, and should be of outstanding interest. A great deal of the work carried out by the Society involving standardization and research in the materials field is of vital interest to industries on the West Coast.

## INSTRUMENT SOCIETY OF AMERICA

### National Conference and Exhibit

The Fourth National Conference and Exhibit of the Instrument Society of America will be held in the Kiel Auditorium, St. Louis, Mo., on September 12-16, 1949. An extensive technical program has been prepared for the five days of the conference, covering all phases of industrial instrumentation and control. To supplement this, a program of social activities and



**Hartford** GUARANTEED  
**STEEL BALLS**  
Best for Burnishing . . . Perfect  
for Polishing. No culls, no cracks.  
Mixtures as Required  
**THE HARTFORD STEEL BALL CO.**  
HARTFORD 6,  
CONN.

## Zialite

Reg. U. S. Pat. Office

## FOR NICKEL PLATING

The one bath especially designed for plating diecastings made of **WHITE METAL ALLOYS** including **ZINC, LEAD, and ALUMINUM**. ZIALITE also plates on **COPPER, BRASS, and IRON**.

USE

## Zialite

## ADDITION AGENTS

for

## HARD CHROMIUM BATHS

Finer-grained deposits.  
Increased throwing power.  
Less sensitivity to sulfate content.

## ZIALITE CORPORATION

92 Grove Street, Worcester 5, Mass.

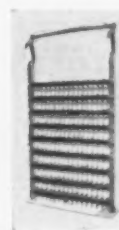
**WHEN IN NEW YORK**



VISIT OUR FREE  
**PERMANENT FINISHES EXHIBIT**  
OPEN DAILY 10 A.M. TO 5 P.M. MONDAY THROUGH FRIDAY  
SAMPLE COPIES OF OUR PUBLICATIONS and  
MANUFACTURERS' CATALOGS AVAILABLE FREE  
at the offices of  
**FINISHING PUBLICATIONS, INC.**  
11 WEST 42nd STREET NEW YORK 18, N. Y.

## THE ARTISAN COMPANY

Manufacturers of TOUGH ELECTROPLATING RACKS



SEND ITEMS TO BE PLATED—ALSO TANK DIMENSIONS—  
FOR IMMEDIATE FREE SKETCHES AND ESTIMATES  
97 Crosby Street, New York City, CAnal 6-7008



ADVERTISING RATES	
Per column inch per insertion	
1 time	\$7.50
3 times	7.00
6 times	6.50
Yearly (12 times)	6.00

## READY-REFERENCE SECTION

—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING  
POLISHING  
RUST PROOFING  
CLEANING  
ANODIC TREATMENT  
ETC.

## FOR SALE

(AVAILABLE FOR IMMEDIATE SHIPMENT)

**PLATERS' BARRELS (REBUILT)**

Motor Drive—3 phase, 60 cycle,  
220/440 volt

40—Mechanical "Horizontal Type" Single and Double barrel units—New and Used. Terrific assortment of Belke and Crowns.

7—UDYLITE "Utility" Platers

30—CROWN — BAIRD — LASALCO — Size No. 1 and No. 2—Ball Burnishers

2—CROWN Roto Finishing Machines

20—BAIRD—GLOBE "Oblique" Tumblers

**POLISHING LATHES — NEW AND USED—CONSTANT AND VARIABLE SPEED, 3 phase, 60 cycle, 220/440 volt.**

**TUBE POLISHER — Production 101 — Motor Drive, complete. Capacity 1/4" to 6". 3 phase, 60 cycle, 220/440 volt.**

**RECTIFIERS: General Electric, Mallory, Udyllite, Selenium, 50 to 1500 ampere sizes, 6 volts with Regulators, 3 phase, 60 cycle, 220/440 volt.**

**PLATING MOTOR GENERATOR SETS (REBUILT)**

**WITH COMPLETE PANEL EQUIPMENT—MOTORS—3 phase, 60 cycle, 220/440 volt SYNCHRONOUS**

1—CHANDEYSSON ELECTRIC 1000/500 ampere, 6/12 volt, 900 RPM. Exciter in head, 40 Deg. C. Serial No. 28874.

1—HANSON-VAN WINKLE-MUNNING 1500 ampere, 12 volt, 900 RPM. Exciter in head. Serial No. 9810.

1—HANSON-VAN WINKLE-MUNNING 2000/1000 ampere, 6/12 volt, 720 RPM. Exciter in head. Serial No. 9939.

1—L'HOMMEDIEU 3000/1500 ampere, 8/16 volt, 900 RPM. Exciter in head. Serial No. 1040.

1—HANSON-VAN WINKLE-MUNNING 4000/2000 ampere, 6/12 volt, 600 RPM. Exciter in head. Serial No. 9635.

2—Ideal Electric 5000/2500 ampere, 9/18 volt, 600 RPM. M.G. Exciter, Serial No. 112875—Serial No. 110705.

2—Chanveysson Electric 5000/2500 ampere, 9/18 volt, 400 RPM. Exciter in head, 25° C. Serial No. 30584—Serial No. 30587.

**ALSO—AVAILABLE—NEW & USED—GENERATOR SETS & RECTIFIERS**  
—Ranging in Size from 50 to 6000 amperes.

**WE CARRY A COMPLETE LINE OF NEW & USED PLATING AND POLISHING EQUIPMENT AND SUPPLIES.**

**CLINTON SUPPLY COMPANY**

112 SOUTH CLINTON STREET  
CHICAGO 6, ILLINOIS

## FOR SALE

Slightly Used

**BUFFS**

Loose and Sewed

Any Quantity

**MICHIGAN BUFF CO., INC.**

3503 GAYLORD AVE.  
DETROIT (12) MICHIGAN

## FOR SALE:



1—G. E. Copper Oxide  
Plate type Rectifier,  
2000 Amperes 6  
Volts, complete with  
Controls

1—Mercil 14" x 30" Plating Barrel Apparatus, motor driven.

1—Asphaltum Lined Wood Tank, 54" L. x 24" W. x 24" D.

1—Asphaltum Lined Wood Tank, 48" L. x 18" W. x 36" D.

All especially priced for quick sale.

**BEAM KNODEL COMPANY**

195 Lafayette St., New York 12, N. Y.  
CAAnal 6-3956-7

## CLEANING AND DRYING MACHINE

FOR SALE—Automatic L. & R Small Parts  
Cleaning and Drying Machine.

CROMWELL MANUFACTURING CORP.  
108 Lawrence Street Brooklyn 1, N. Y.

## 7500 AMP. 9 V. M-G SET

FOR SALE—CHANDEYSSON—BUILT 1944  
—PERFECT COND. Compound winding, 67.5 KW, 300 rpm, 25° C. 150 HP Chanveysson motor with Exciter. Address September 1, care Metal Finishing, 11 West 42nd Street, New York 18, N. Y.

**MOTORS, GENERATORS,  
TRANSFORMERS**



1 — 1500 H.P.  
Bought and Sold  
New and Rebuilt

**ELECTRIC EQUIPMENT CO.**  
ROCHESTER 1, N. Y.

## AVAILABLE FOR IMMEDIATE SHIPMENT—ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—15,000/7500 Ampere, 6/12 Volt. Columbia Electric Co. With Separate M.G. Exciter.

1—10,000/5000 Ampere, 25/50 Volt. Chanveysson Electric Co. Synchronous Motor, 5 years old. Like New. Excellent for Anodizing.

1—5000/2500 Ampere, 6/12 Volt. Eager Electric Co. Separately Excited, Excellent Condition.

1—5000/2500 Ampere, 6/12 Volt. Munning "Optimus". Separately Excited.

1—4000/2000 Ampere, 9/18 Volt. General Electric Co. Synchronous Motor.

1—4000/2000 Ampere, 6/12 Volt. Hanson & Van Winkle Co. Compound Wound, Separately Excited.

1—3000/1500 Ampere, 6/12 Volt. Chanveysson Electric Co. Synchronous Motor, Separately Excited. Exciter-in-Head.

1—3000/1500 Ampere, 6/12 Volt. Electric Products Co. Synchronous Motor, Separately Excited.

1—2000/1000 Ampere, 12/24 Volt. Hanson-Van Winkle-Munning Co. Excellent Condition, Separately Excited.

1—2000/1000 Ampere, 6/12 Volt. Chanveysson. Excellent Condition, Late Type, Synchronous Motor, Exciter-in-Head.

1—1500/750 Ampere, 6/12 Volt. Hanson-Munning Co. Shunt Wound, Separately Excited.

2—1000/500 Ampere, 6/12 Volt. Charles J. Bogue Electric Co. Separately Excited, Interpole Design, Exciter-in-Head.

1—1500 Ampere, 40 Volt. Hanson-Munning Anodizing Synchronous M.G. Set, Automatic Controls, Exciter-in-Head.

1—1000 Ampere, 40 Volt. Chanveysson Anodizing Synchronous M.G. Set, Automatic Controls, Exciter-in-Head.

1—1000 Ampere, 25 Volt. Hanson-Van Winkle-Munning Co. Separately Excited. Anodizing Unit.

OTHER SIZES OF ELECTROPLATING AND ANODIZING MOTOR GENERATOR SETS IN STOCK.

4—G.E. Copper Oxide Rectifiers. 500 Amperes, 6 Volts, for operation on 220/3/60.

10—400 Ampere, 6 Volt. Udyllite-Mallory Rectifiers, with built-in Regulators.

1—2000 Ampere, 6 Volt. General Electric Co. Copper Oxide Rectifier, for 220 volt, 3 phase, 60 cycle input.

2—1440/720 Ampere, 6/12 Volt. Udyllite-Mallory Rectifiers, for 220/440 volt, 3 phase, 60 cycle input.

**M. E. BAKER COMPANY**  
25 WHEELER ST., CAMBRIDGE, MASS.  
KIRKLAND 7-5460